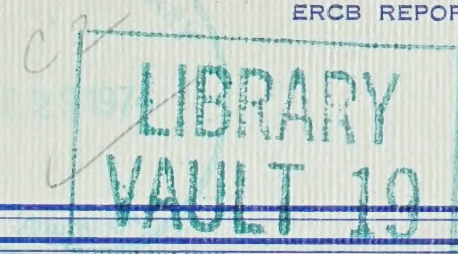


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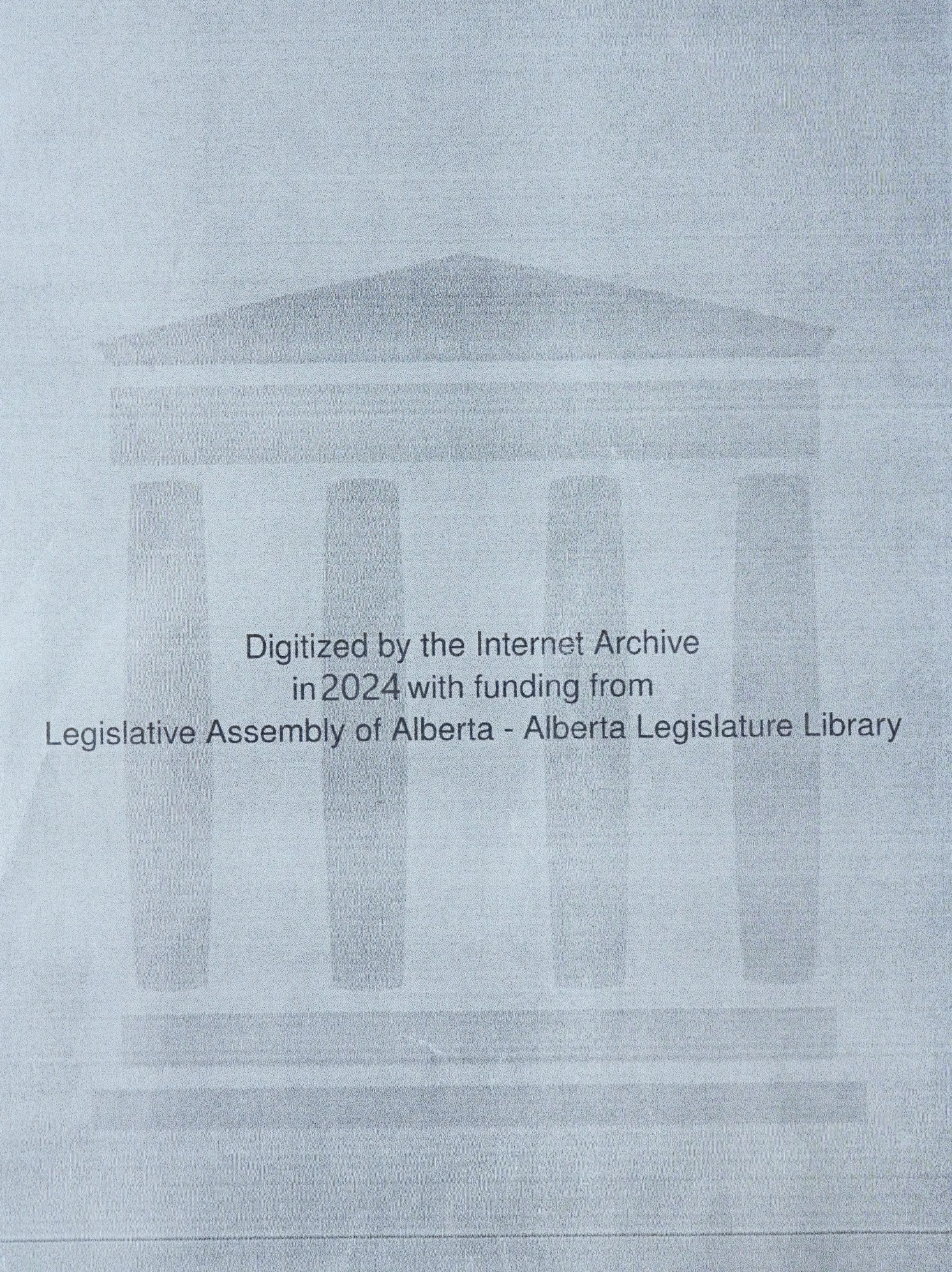


REPORT AND DECISION ON THE APPLICATION OF THE
INDEPENDENT PETROLEUM ASSOCIATION OF CANADA
FOR A DISCOVERY ALLOWABLE

< Alta

ENERGY RESOURCES CONSERVATION BOARD

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APRIL, 1972

ENERGY RESOURCES CONSERVATION BOARD

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I INTRODUCTION

The Hearing

The Independent Petroleum Association of Canada applied to the Energy Resources Conservation Board for a modification of the plan for the proration of oil to market demand to provide that, for all new light and medium gravity crude oil pools discovered on and after May 1, 1969, each well in the pool be granted for a period of five years a discovery allowable increasing with the depth of the producing pool.

The Board heard the application November 30 and December 1, 1971, with G. W. Govier, P. Eng., V. Millard and D. R. Craig, P. Eng., sitting.

Appearances

The persons listed in Table I-1 appeared at the hearing. Shell intervened for the purpose of cross-examination and argument only.

The Applicant and its Application

IPAC is an association with 188 member companies, all but two of which are active in Alberta. These include 145 active oil companies. Of the members those that participated individually were Aquitaine, Dome, Home and Western Decalta.

In the application, IPAC contended that significant changes in regard to industry finding rates, exploratory drilling, exploration and development costs, and markets had occurred since 1964 and now justify the adoption of a discovery allowable. IPAC proposed that all wells drilled in light and medium gravity crude oil pools placed on production after May 1, 1969, be granted a discovery allowable commencing on the date of the Board's adoption of the proposal embodied in the application, and extending until a date five years after the on-production date of the first well in the pool. The discovery allowable would vary with the average depth of the wells in the pool and would range from a minimum of 30 barrels per day for wells down to 3,500 feet deep to a maximum of 190 barrels per day for wells over 11,501 feet deep. The present minimum

TABLE I-1
APPEARANCES

Abbreviation of Name Used in Report		Represented by	Witnesses
Independent Petroleum Association of Canada			
Amoco Canada Petroleum Company Ltd.			
Aquitaine Company of Canada Ltd.			
Atlantic Richfield Canada Ltd.			
Canadian Association of Oilwell Drilling Contractors			
Alberta Division of the Canadian Petroleum Association			
Chevron Standard Limited			
Dome Petroleum Limited			
Gulf Oil Canada Limited			
Home Oil Company Limited			
Imperial Oil Limited			
Mobil Oil Canada, Ltd.			
Shell Canada Limited			
Union Oil Company of Canada Limited			
Western Decalta Petroleum Limited			
Board Staff			
IPAC		R. A. MacKimmie, Q.C.	C. S. Dunkley, P. Eng. A. G. Morison, P. Eng.
Amoco		D. C. Smith, P. Eng.	D. C. Smith, P. Eng.
Aquitaine		E. A. Pantella	E. A. Pantella
ARCO		B. B. Wells, P. Eng.	B. B. Wells, P. Eng.
CAODC		J. H. Storey	J. H. Storey
CPA		G. E. Little	R. H. Swann, P. Eng.
Chevron		L. C. Zerr, P. Eng.	L. C. Zerr, P. Eng.
Dome		M. E. McElroy, P. Eng.	M. E. McElroy, P. Eng.
Gulf		J. B. McDonald, P. Eng.	J. B. McDonald, P. Eng.
Home		A. G. Morison, P. Eng.	A. G. Morison, P. Eng.
Imperial		R. B. Peterson, P. Eng.	R. B. Peterson, P. Eng.
Mobil		D. D. Brown, P. Eng.	D. D. Brown, P. Eng.
Shell		J. M. Killey	
Union Oil		D. S. Paxman, P. Eng.	J. T. Duree
Western Decalta		E. L. Morris, P. Eng.	E. L. Morris, P. Eng.
		R. G. Evans, P. Eng. N. A. Macleod, Q.C. H. J. McFadyen	

allowance allocated to wells at the maximum depth indicated in the IPAC submission, 12,000 feet, is 34 barrels per day. The applicant submitted that the discovery allowables should be subject to normal gas-oil and water-oil ratio penalties and should apply only when the reserves-based allowable (see Appendix D for definitions) given to the well was less than the discovery allowable. It proposed that the general administration of the discovery allowable would be similar to that applied to the minimum allowance under the Board's present plan, but that the discovery allowable for wells in a production spacing unit (PSU) would be allocated in addition to reserves-based allowables for undrilled tracts, would be transferable from well to well, and would be redistributed within the pool if the producing wells were incapable of producing their allowable.

The applicant stated that the primary purpose of such a discovery allowable would be to provide an incentive for the drilling of development wells following the initial discovery well.

The applicant proposed that a maximum of one discovery allowable should be granted per quarter section, even if the drilling spacing unit (DSU) size was less than a quarter section. The applicant also proposed that the discovery allowable would be in addition to the 1,000-barrel "new well test allowable" granted under the current allowable system.

The Interveners and Interventions

Amoco. Amoco, a member of CPA, is a wholly owned subsidiary of Standard Oil Company (Indiana) and conducts an exploration program in Alberta. In 1970, Amoco's Canadian net crude oil and natural gas liquids production amounted to 58 thousand barrels per day, with natural gas production totalling about 300 million cubic feet per day. Amoco is among those ten large companies arbitrarily defined by the Board, for the purpose of evaluating this application, as "major operators". The definition of "major" and "minor" operators is discussed more fully in Section IV in connection with Figure IV-8, and in Appendix B. Amoco stated that it would favour the development of a program for encouraging exploration in Alberta. It submitted that the IPAC proposal would encourage

overdrilling of infill wells, divert funds that might otherwise be used for exploration, and diminish the incentive for enhanced recovery programs. Further it said that if a discovery allowable was to encourage exploration it should go to wells that were stepped out at least two miles, and should not apply retroactively to pools defined since May 1, 1969. It submitted that the hearing had shown the IPAC proposal to be an infield subsidization program, likely to provide neither significant new reserves nor any conservation benefit.

Aquitaine. Aquitaine, a member of CPA and IPAC, is a Dominion company and a subsidiary of Société Nationale des Pétroles d'Aquitaine. Aquitaine explores for oil and gas in Alberta and in 1970 its net Canadian production was 21 thousand barrels per day of crude oil and natural gas liquids plus 21 million cubic feet per day of natural gas. It is included in the Board's list of "minor operators". Aquitaine opposed the IPAC application. It advocated a joint Government-Industry task force to review the broad range of incentives available, and contended that incentives should not be applied solely through the proration plan. It criticized the retroactive feature of the IPAC proposal, and also stated that the proposal would encourage excessive development of known reserves, diverting funds from exploration.

ARCO. ARCO is a wholly owned subsidiary of the United States corporation, Atlantic Richfield Company and is a member of CPA. ARCO conducts an exploration program in Alberta, and in 1970 it had net Canadian crude oil and natural gas liquids production of 37 thousand barrels per day plus about 70 million cubic feet per day of net natural gas production. It is included in the Board's list of "minor operators". ARCO stated that it was in accordance with the concept of a discovery allowable scaled according to the average producing depth of the pool. It was in agreement with the proposed scale of discovery allowables proposed by the applicant, with the concept that the greater of the discovery allowable or the normal allowable should be applied and that the maximum five-year period was appropriate. However ARCO disagreed with the retroactive feature of the IPAC proposal as it might divert funds from exploration to development drilling. Also, instead of applying the discovery allowable on a per well basis, it proposed that it be applied to drilling spacing units included in the production

spacing units in order that unnecessary development wells would not be encouraged.

CAODC. This association supported the application of IPAC. It submitted data and analyses relating to the decline of drilling operating days in the Province between 1968 and 1970, the financial consequences of such a decline to the drilling contracting industry, the economic impact of the decline on other interrelated and dependent industries, and employment data related to these matters. It submitted that the present proration plan has hindered exploration for additional crude oil reserves, has caused exploration to be concentrated in areas where potentially high reserves might be found, has discouraged exploration due to lack of incentives to find low reserves pools, and has had the effect of inhibiting the discovery of gas reserves due to lack of drilling. It submitted that about 20 per cent of the unemployment in Alberta may be attributed to the down-turn in drilling activity in the Province, and stated that the reduction in drilling activity for the first nine months of 1971 represents a loss to Albertans of 4,242 man-years of employment or \$34,000,000 in payroll. Mr. Storey testifying for CAODC, conceded that some of this loss would be attributable to causes other than the proration plan.

CPA. General support of the IPAC proposal was given by CPA. When it consulted its membership of about 85 companies, some 34 members approved without comment, 18 to 20 indicated reservations, and 2 were wholly opposed. The reservations of some members to the application of discovery allowable to all wells in a pool were because it could result in over development of a pool by closely spaced wells, diminished incentives to establish enhanced recovery projects, and diversion of funds to drill unnecessary development wells which otherwise might have been used for exploration. Also, the justification of the retroactive feature as an incentive for future exploration was questioned. Further, CPA suggested that industry should be given full opportunity to examine, assess and present to the Government the merits of all possible means of stimulating exploratory drilling in the Province.

Chevron. Chevron is a wholly owned subsidiary of Standard Oil Company of California, and maintains an exploration program in Alberta. In 1970, Chevron's net production was 63 thousand barrels per day of crude oil and natural gas liquids and 179 million cubic feet per day of natural gas in Canada. It appears as a "major operator" in the Board's grouping of operators and is a member of CPA. Chevron supported the concept of discovery allowables. It submitted, however, that the allowable for a production spacing unit should be either the discovery allowable for the well or the acreage allocation for the production spacing unit, whichever is greater. It also disagreed with the retroactive feature of IPAC's proposal as being not justified as an exploration incentive.

Dome. Dome, a member of IPAC, is a Dominion company. Its net 1970 Canadian production was 18 thousand barrels per day of crude oil and natural gas liquids with 148 million cubic feet per day of natural gas. The company explores in Alberta and is included in the Board's list as a "minor operator". Its intervention accorded full support to the IPAC application.

Gulf. Gulf is an integrated Dominion company, affiliated with the United States corporation, Gulf Oil Corporation. It is a member of CPA and maintains an exploration program in Alberta. In 1970, Gulf's Canadian net crude oil and natural gas liquids production was 92 thousand barrels per day plus 394 million cubic feet per day of natural gas. It is included in the Board's list of "major operators". Gulf submitted that a package of incentives for exploration should be developed in conjunction with the Provincial Government, with the most meaningful incentives being in the area of land regulation. It opposed the IPAC proposal as being concerned with the drilling of unnecessary development wells. It submitted there is no justification for granting bonuses to all development wells in the pool or to giving the allowables to anyone who has not participated in the risks in finding the pool. It stated that any such allowance should go only to wells discovering a pool on or after January 1, 1972, or a well revealing a four-mile extension to a pool, it should not be transferable and should provide a reasonable payout of the drilling and completion costs over a period of three years and thereupon terminate. It stated that the

qualifying well should receive the greater of the discovery allowable or an allowable in accordance with the present system.

Home. Home is a Dominion company, recently affiliated with 'The Consumers' Gas Company, and is a member of CPA and IPAC. Its net Canadian 1970 production of crude oil and natural gas liquids was 19 thousand barrels per day plus 89 million cubic feet per day of natural gas. Home explores for oil and gas in Alberta and is listed by the Board as a "minor operator". It supported the IPAC proposal as encouraging exploration. Home expressed the opinion that it would have little effect on the allowables in existing pools and that it would not tend to discourage enhanced recovery operations.

Imperial. Imperial is an integrated Dominion company, affiliated with Standard Oil of New Jersey. It is a member of CPA and explores in Alberta. In 1970, Imperial's net Canadian production was 170 thousand barrels per day of crude oil and natural gas liquids plus 349 million cubic feet per day of natural gas. It is included in the Board's list of "major operators". Imperial opposed the IPAC proposal claiming that it asked existing producers to subsidize marginal developments which would result in an unreasonable allocation of crude oil markets. It stated that the IPAC proposal would deter enhanced recovery operations, was designed to increase capacity to produce high cost oil and in its retroactive feature, would not encourage exploration. It stated that what had depressed exploration drilling activity had been the lack of success and that greater encouragement for exploratory activity could be achieved through changes in land, royalty and income tax regulations.

Mobil. Mobil, a member of CPA, is a wholly owned subsidiary of a United States corporation, Mobil Oil Corporation. It maintains an exploration program in Alberta and in 1970 its net Canadian production was 97 thousand barrels of crude oil and natural gas liquids per day and 171 million cubic feet per day of natural gas. Mobil is listed as a "major operator" by the Board. Mobil stated that the concept of a discovery bonus would be acceptable if it did not weaken the incentives to develop reserves and if there was a minimum of inequity to pools now producing. It stated that the IPAC proposal could weaken the incentives now in the proration system and encourage exploration for

smaller, less economic pools. It could lead also to the overdrilling of new pools. Mobil suggested an alternative plan under which the discovery allowable would be granted to wells discovering new pools or extending existing pools by more than four miles, to be calculated by doubling the reserves-based allowable assigned to the well without affecting the well's minimum allowance, to apply for two years following the date of rig release from the well, to be subject to gas-oil ratio and water-oil ratio penalties and to be transferable in accordance with the PSU regulations. This allowable would be available to eligible wells which commenced drilling on or after the date of the Board's decision.

Union Oil. Union Oil is a Dominion company, and a subsidiary of Union Oil Company of California. A member of CPA, it has an integrated Canadian operation, including exploration in Alberta. Its 1970 Canadian net production of crude oil and natural gas liquids was 33 thousand barrels per day and natural gas totalled 44 million cubic feet per day. Union Oil is included in the Board's classification of "minor operators". In support of the IPAC application, Union Oil stated that the present system inhibits the development of apparent low reserve discoveries and that the granting of an umbrella allowable for a limited period of time would aid in determining the extent of such discoveries.

Western Decalta. Western Decalta is a Dominion company and a member of IPAC. Western Decalta explores for oil and gas in Alberta, and in 1970, had net Canadian production of 4 thousand barrels per day of crude oil and natural gas liquids and 14 million cubic feet per day of natural gas. Western Decalta, included in the Board's "minor operator" classification, supported the application.

II PROVISIONS OF THE OIL AND GAS CONSERVATION ACT AND THE PRESENT PRORATION PLAN

The Provisions of the Act

The sections of The Oil and Gas Conservation Act which are relevant to the application are shown below.

Section 5 reads, in part:

"5. The purposes of this Act are

- (a) to effect the conservation of, and to prevent the waste of, the oil, gas and crude bitumen resources of Alberta,
- (b) to secure the observance of safe and efficient practices in the locating, spacing, drilling, equipping, completing, reworking, testing, operating and abandonment of wells and in operations for the production of oil, gas and crude bitumen,
- (c) to afford each owner the opportunity of obtaining his share of the production of oil or gas from any pool or crude bitumen from any oil sands deposit,"

Section 22, subsection (1) reads, in part:

"22. (1) The Board may make regulations

- "10. prescribing rules by which the base allowable of a well in a production spacing unit or of a block or project may be determined;"
- "32. prescribing rules for the calculation of allowables, maximum production rates, penalty factors, penalties and overproduction or underproduction status;"
- "44. generally to conserve oil and gas, and to prevent waste or improvident disposition thereof, and to do any other matter reasonably incidental to the development and drilling of any oil or gas wells, the operation thereof, and the production therefrom."

Allowables for oil wells producing in Alberta are established by the Board under section 34, subsection (1) of the Act, which reads:

"34. (1) The Board may, by order, restrict the amount of oil and gas produced in association with the oil that may be produced in Alberta

- (a) by fixing a provincial allowable for crude oil, condensate and pentanes plus not exceeding the market demand as determined by the Board,
- (b) by allocating the provincial allowable for crude oil, condensate and pentanes plus in a reasonable manner among the producing pools in Alberta by fixing the amount of crude oil or condensate that

may be produced from each pool, or of pentanes plus that may be produced from each plant, without waste, to meet the provincial allowable so determined, and

- (c) by distributing the portion of the provincial allowable allocated to a pool in an equitable manner among the wells in the pool, for the purpose of giving each well owner the opportunity of producing or receiving his just and equitable share of the oil in the pool."

Section 36 of the Act, under the heading "Conservation Projects" provides, in part, that:

"The Board may, by order,

- (a) control and regulate the production of oil, gas and water by restriction, proration or prohibition,"

History of Proration

The discovery of oil in the Leduc Field in 1947, and in the Redwater Field in 1948, and the rapid development of these and other fields in nearby areas, led to a situation in Alberta in which oil producing capability substantially exceeded the market demand in 1949 and thereafter. The oil purchasers adopted a system of pipe line acceptances, but after a few months when it became apparent that this was not workable, the industry appealed to the Board and the government to establish a system of crude oil proration to market demand under the provisions of The Oil and Gas Resources Conservation Act, 1950.

The plan instituted by the Board after a public hearing provided for the periodic determination of the demand for Alberta crude oil, divided into three categories of crude oil density - light, medium and heavy. The first two categories were later combined. Since demand for heavy crude oil exceeded the productive capacity of the pools in this category there was no need for proration. This situation still exists, for the most part.

Light and medium crude oil allowables were determined by providing for an "economic allowance" for each well, and in addition, a share of the residual market demand. The well economic allowance was a function of the depth of the well, and was designed to reflect the cost of drilling and operating the well. The share of the residual demand was determined by calculating for each pool a "maximum permissible rate" (MPR) which was related to the pool reserves and the characteristics of the average well in the pool. The pool's share of the residual demand

was based on the pool MPR relative to the sum of the MPR's of the pools in the category. This share was divided equally among the wells in the pool. The plan was modified shortly after its inception to penalize excessive depletion of reservoir energy, and to take into account the productivity of the wells and pools.

Certain aspects of the plan were reconsidered in 1957, and some amendments were introduced, primarily with respect to the level of the economic allowance. A two-level economic allowance system was adopted, which provided for a higher level of economic allowance in a pool for a maximum period of seven years to allow an operator the opportunity to recover both his drilling and completion cost, and a lower economic allowance thereafter, intended to defray operating costs.

The trend during the next few years towards implementation of unit operations and enhanced recovery schemes, occasioned a further review in 1961 of the method of determining the economic allowance for such schemes. The Board's decision was, in effect, to continue the assignment of the economic allowance on a well basis, and to allow accumulation and transfer of these allowances within schemes and units.

During the next few years it was suggested by various persons that the proration plan suffered from several deficiencies, including the encouragement of the drilling of unnecessary wells, insufficient incentive to maximize recovery by installing enhanced recovery schemes, insufficient incentive to explore for new oil reserves, administrative complexity and encouragement of unnecessarily high operating costs. A hearing to review the plan was held in 1963, and the Board's decision was issued in 1964. This decision is contained in OGCB Report 64-10 "Report and Decision on Review of Plan for Proration of Oil to Market Demand in Alberta", and is the basis of the present proration plan. The historical development of proration, and the evidence and arguments adduced at the 1963 hearing are discussed in more detail in that report. The basic changes were to reduce substantially the impact of the minimum allowance and to allocate the market demand on the basis of recoverable reserves. The minimum allowance became a floor allowance, and a schedule was designed to provide a series of transitional steps, with the transition being complete on May 1, 1969. Further details of the present plan are given later in this Section.

Minor modifications have been made to the proration plan since publication of OGCB Report 64-10, dealing primarily with the methods of redistribution of productive incapability within a pool, the determination of the minimum allowance for projects, the determination of penalties and allowables for single well pools, and the provisions for determination and carry forward of underproduction.

Objectives of the Proration Plan

The views of the Board and Industry as to the objectives of a proration plan, at the time of publication of OGCB Report 64-10 in July, 1964, were discussed in detail in that report. Those views are quoted or summarized below. Where necessary, references to the current statute have been inserted.

(i) "Objectives under the Proration Provisions of the Statute

The Board considers that the primary objectives of a plan must be those indicated by sections 4 and 36 (now sections 5 and 34) of The Oil and Gas Conservation Act, namely

- (a) the allocation of the provincial allowable among producing pools in a reasonable manner and so that it may be produced without waste (section 36, subsection (1), clause (b)) (now section 34, subsection (1), clause (b)),
- (b) the distribution of each pool's allocation among wells in the pool in an equitable manner (section 36, subsection (1), clause (c)) (now section 34, subsection (1), clause (c)),
- (c) the prevention of waste of oil and gas resources and their conservation (section 4, clauses (b) and (a)) (now section 5, clause (a)), and
- (d) the giving to each owner the opportunity of obtaining his just and equitable share of the oil in the pool (section 4, clause (d) and section 36, subsection (1), clause (c)) (now section 5, clause (c) and section 34, subsection (1), clause (c))."

(ii) "Objectives Indicated by Other Provisions of the Statute

The Board is of the opinion that, as the aim of The Oil and Gas Conservation Act as reflected in its provisions generally is the prevention of waste and the conservation of the Province's oil and gas resources, then, as may be feasible and compatible with the proration provisions of the statute, a proration plan should be so designed as to encourage the effort of industry to

maximize the recovery of oil from proved reserves. The Board, ...finds that there are three basic objectives of this nature that should be considered separately rather than only as a consequence of primary objectives, pertaining to recovery stimulation, well abandonment and low reserve per acre pools."

"(1) To encourage efforts to enhance the recovery from pools"

"The Board agrees with industry that it is highly desirable that the proration plan adopted be one which would, in all circumstances, encourage maximum recovery of oil and gas.

(2) To discourage the abandonment of wells before the production of all apparently economically recoverable oil"

"The Board agrees with industry that the proration plan should provide allowables sufficiently high to prevent the abandonment of wells physically capable of an economic rate of production.

(3) To assure production from low reserve per acre discoveries which appear economically recoverable"

"In order to assess the views expressed in the proper perspective the Board has made an analysis of the distribution of the total recoverable reserves of the Province as now known and the distribution of wells presently qualified for an allowable over the range of recoverable reserves per acre. This distribution is given in Figures 1 and 2 respectively. From Figure 1 it is apparent that only about 1 per cent of the reserves fall below the category of 500 barrels of recoverable reserves per acre. Correspondingly, Figure 2 indicates that less than 5 per cent of the qualifying wells are located in pools with reserves below 500 barrels per acre. In the Board's opinion this indicates that reserves below 500 barrels per acre are of little significance and that reserve in the range of 500 to perhaps 2,000 barrels per acre are those which might be referred to as low reserve per acre pools. This category includes that part of the Pembina Field under primary recovery operations and about 50 very small pools of the some 280 pools in the Province, all of which together aggregate about 11 per cent of the reserves of the Province, and contain about 21 per cent of the total qualifying wells.

It is the Board's opinion, on the basis of its analysis, that the volume of reserves contained within low reserve per acre pools, and the number of wells affected are sufficiently large that production from such pools and the continued economic operation of the wells in them are necessary in the interest of conservation. The Board realizes that such production could have a slightly adverse effect on the overall cost of producing oil in the Province, but believes that such an effect should be considered secondary to conservation. The Board thus concludes that the share of production assigned to low reserve per acre pools must be sufficient to allow production from them."

Other Desirable Objectives

"The objectives discussed under this heading represent those not directly indicated by the provisions of The Oil and Gas Conservation Act, but which industry and the Board feel should be satisfied as far as possible by a sound proration plan. In a number of submissions, objectives within this category were considered by their proponents to be of primary importance. The order in which these objectives are presented below has no significance.

- (1) To provide a system which is relatively simple to administer"

"The Board believes that, as far as is practical, the administrative burden should be minimized, but does not believe that important principles should be sacrificed for the sake of simplicity.

- (2) To provide a method of allocation operable over a wide range of market conditions, both as to supply and demand, and allow continuity in the production from and development of pools"

"It is the Board's opinion, in agreement with industry, that it would be desirable if the basic allocation formula in a proration plan could remain unchanged while accommodating wide fluctuations in demand, productive capacity, price and costs. On the other hand the Board recognizes that changes in the conditions under which the industry operates could necessitate review of the plan and that it may be desirable to make amendments following such reviews.

- (3) To encourage exploration and not deter any party interested from exploring for new reserves"

"The Board does not believe the stimulation of exploration to be a prime objective of prorating, but does believe it desirable, both from the point of view of maintaining long term supplies and a healthy industry. It is the Board's opinion that, insofar as excessive development of known reserves is diverting expenditures from exploration, then as far as practical a future proration plan should operate to correct this trend. The Board believes, however, that this could well be accomplished through a plan which meets the major objectives, and that further, specific incentives are unnecessary.

- (4) To maintain the participation in the industry by anyone interested"

"The Board agrees with the general view of industry that broad participation in the exploration for and production of crude oil is desirable, and that a proration plan should not incorporate special provisions of advantage to any particular group.

- (5) To encourage the economic optimum development within pools, and minimize the cost of oil"

"The Board agrees that pools should be developed with a minimum of unnecessary wells, and that it is desirable that the costs of producing crude oil be kept to a minimum. The Board recognizes, however, that certain features of a plan necessary to promote the major objectives may not be wholly compatible with the minimization of costs."

The report later states:

"The Board does not accept the view of IPAC that the prime purpose of a minimum allowance is to pay out drilling costs and thus provide an incentive for exploration."

Subsequently the report reads:

"The Board sees no fundamental basis for treating a discovery well other than as a one-well pool for which an arbitrary area must be assigned."

Description of the Proration Plan

The proration plan adopted by the Board in 1964, plus minor amendments since that time, came into full effect on May 1, 1969. The plan provides for the determination of the total demand for light and medium crude oil from Alberta, and for calculation of allowables to accomplish its distribution between pools on the basis of the recoverable oil reserve contained in the pool. Distribution of the pool allowable among wells in the pool is on the basis of the validated acreage assigned to each well and the recognized recovery factor. The plan also provides for a minimum or floor allowance for each well which varies from a low of 10 barrels per day for wells less than 2,400 feet deep, to a maximum of 50 barrels per day for wells 15,000 feet deep. A graphical representation of the minimum allowance is shown as Figure VII-1. The Board stated that the level of minimum allowance was designed to be

"...large enough, but no larger, than necessary to prevent premature abandonment and reasonably to permit production from and prevent the waste of all significant reserves discovered and the continued production of all wells physically capable of production at economic rates."

The report further reads:

"...the Board does not believe the minimum allowance need be designed to permit recovery of drilling costs. It believes the allowance should generally reflect recovery of well completion and operating costs and to permit an adequate return on the investment in completion costs."

The plan provides for imposition of penalties to prevent waste of reservoir energy and for exemption of certain pools from the proration plan when this is desirable in the interest of conservation, or when proration is unnecessary as a result of productive incapability in the pool.

Provision is included for grouping of lands into production spacing units, blocks or projects and for recognition for allowable purposes of certain undrilled acreage if it is judged potentially productive.

The previous practice of assigning minimum allowance to non-producing wells was discontinued. The Board continued its principle that prorated allowables are subject to a maximum rate limitation (MRL) where necessary to prevent damage to ultimate recovery.

III IDENTIFICATION OF THE MAJOR ISSUES

The IPAC application to modify the proration plan through the introduction of a discovery allowable raises a number of issues. These are identified and briefly described below.

Need for Incentives for Exploration

IPAC contended that a decline in crude oil discoveries and new field wildcats drilled over the 1966 to 1970 period indicated the need for additional exploration incentives in the Province. All of the interveners supported the need for additional exploration incentives. The Board believes that the need or otherwise for new or further incentives to encourage exploration in the Province should be appraised. It considers this to be a major issue.

Need for Incentives for Development of Low Reserve Per Acre Pools

IPAC contended that the minimum allowances available under the current proration plan did not make it economically attractive to develop crude oil discoveries with low accredited reserves per acre and that some additional incentives were therefore required. The interveners were mixed in their views respecting this matter with some supporting the IPAC position without comment while others stated that sufficient incentives were presently available to develop the ultimate recoverable reserves of the Province. The Board considers the question of the need or otherwise for new or further incentives for the development of low reserve per acre pools to be a major issue.

Suitability of a Special Allowable as an Incentive for Exploration and Development of Low Reserve Per Acre Pools

IPAC requested that a particular form of special allowable be established to stimulate exploration and the development of low reserve per acre pools in the Province. If the Board determines that new or further incentives are necessary to increase exploration or development in Alberta, it must be determined whether or not a special allowable is a suitable way to provide the incentive. This is a major issue.

Suitability of the Specific IPAC Proposal as an Incentive for Exploration and Development of Low Reserve Per Acre Pools

The specific IPAC application is for a special allowable scaled to well depth and which would provide for a 2.5 year pay-out of drilling costs. If the Board should determine that a special allowable is warranted as a new or further incentive for exploration or development the question remains as to whether the specific IPAC proposal is suitable.

The views of IPAC, of the various interveners and of the Board on each of these issues are given in the following sections.

IV NEED FOR INCENTIVES FOR EXPLORATION

(1) Views of IPAC

IPAC asserted that significant changes in industry finding rates, exploratory drilling, exploration and development costs and oil markets have occurred since 1964 which now justify adoption of incentives to encourage exploration. It submitted a tabulation (Table IV-1) covering the period 1966-1970 which illustrates the decline in the rate of crude oil discoveries and in the number of new field wildcats drilled. The tabulation showed that seismic crew-months worked, and new field wildcats drilled, had dropped more than 40 per cent in the last four years. IPAC acknowledged that some other measures of exploration activity, such as new pool wildcat or outpost wells drilled, did not necessarily indicate a decline, as did the new field wildcat wells. Also it accepted that, in any oil development area, primary exploration on new field wildcats must eventually decline and other exploratory activity would then become a more significant factor.

IPAC observed that exploration costs had increased materially in recent years due to the need to explore in remote areas, new techniques in seismic exploration, increased data processing charges and higher costs of labour, material and services. These, it said, combined with the drop in finding rates had had a serious dampening effect on exploratory efforts in Alberta.

In its questioning, IPAC introduced data to suggest that the number of new field wildcats drilled by some major operators in the Province had decreased dramatically since 1965. In the same vein, IPAC mentioned statistics to indicate that some major operators had reduced their land holdings in Alberta in the order of 50 per cent in the period 1965 to 1970. IPAC also testified that Alberta had suffered materially in the last few years due to reduced revenues from Crown land sales.

It agreed with the submission by CAODC which indicated that the annual footage of wells drilled, the amount of money spent and the number of people employed in the drilling industry had recently declined and that this was an unhealthy situation for the Province. IPAC maintained that in many areas of Alberta, exploration for oil had fundamentally

TABLE IV-1**

EXPLORATORY ACTIVITY AND GROWTH OF RESERVES - ALBERTA 1966 - 1970*

CRUDE OIL RESERVES (Thousands of Barrels)								
Year	Seismic Crew Month	New Field Wildcats Drilled	Proved Remaining at Dec. 31 Prior Year	Revisions	Extensions	Discoveries	Production	Proved Remaining at Dec. 31
1966	548	503	5,719,683	525,889	310,925	364,032	200,029	6,720,500
1967	628	473	6,720,500	317,088	33,643	183,417	224,599	7,030,049
1968	509	485	7,030,049	297,889	50,973	124,395	250,287	7,253,019
1969	554	421	7,253,019	432,105	53,461	78,473	273,863	7,543,195
1970	347	282	7,543,195	197,708	38,459	31,606	315,401	7,495,567

* Source - CPA Year Books 1966 - 1970.

** This table is a reproduction of Table #1 from the IPAC submission.

ceased due to the allowable system. It stated that there was a need for incentives which would encourage exploration for all types of oil reserves in Alberta, and that if such incentives were initiated, additional oil fields would be discovered. However, it was acknowledged that exploration incentives would only accelerate the rate of discovery of reserves in the Province, but would not increase the number of barrels ultimately discovered.

IPAC agreed that when proration is no longer required then specific exploration incentives would develop automatically and that additional incentives would not be required. Conversely, however, IPAC alleged that the existing proration plan "breaks down" to some extent when the allocation factor rises above 150 barrels per day per million barrels of proratable reserves, and that an increase in demand above that level would not necessarily provide increased incentives for exploration for new reserves. It questioned whether the market demand would exceed productivity in the near future, and thus eliminate the need for proration, as predicted by some parties.

In its response to a question as to whether the absence of market restrictions in the Province of Saskatchewan had encouraged exploration, IPAC commented that it had not investigated the matter, but claimed that a difficult land holding situation had inhibited exploration in that Province. IPAC maintained that although it could not prove that additional incentives would achieve solution of the problems, there would certainly be no negative effects.

(2) Views of the Interveners

Amoco expressed support for the general objective of encouraging exploration within the Province, stating that there had been a decline in some exploration activity in recent years. However, in its opinion there had not been a major movement of exploration funds out of Alberta, and the oil production industry had been spending an ever increasing amount of money on exploration in the Province. Amoco did not agree that the decline in the number of new field wildcats, as indicated by the IPAC submission, was the uniquely significant index of exploratory activity as claimed, and questioned whether this decline was closely related to

the current proration system in the Province as the 45 per cent decline in Alberta compared favourably with a 65 per cent decline in proration-free Saskatchewan over the same period.

Aquitaine indicated support for the idea that incentives for exploration were needed, recognizing a decline in exploration activity in Alberta, and that this decrease may be detrimental to the industry as well as to the Province. Aquitaine urged that the development of such incentives should not be deferred for any extensive period, and advocated an Industry-Government task force to review both the need for exploratory incentives and the broad range of incentives available.

CAODC voiced strong support for the view that greater incentives for exploration were required, claiming that additional oil and gas reserves would be discovered as a result. It supplied data which indicated declines since 1968 in rig operating days, drilling expenditures, total related expenditure and employment in the drilling industry. Rig operating days, considered the primary index of drilling activity, showed a 26.5 per cent decline during the first nine months of 1971 from the comparable 1968 period. (See Figure IV-6). CAODC analyzed the Alberta labour content of exploratory and development drilling and concluded that a reduction of some 4,242 man years of employment, or \$34 million in wages, had occurred during 1971 compared to 1968. This economic loss resulting from a decline in drilling activity was related to a postulated lack of incentive in the current proration plan.

CAODC maintained that the number of exploratory wells drilled was a poor measure by which to determine a need for exploratory incentives, as depth per well was a major factor influencing rig operating days which was the index of activity preferred by CAODC. A suggestion that technological advances may have contributed to the decline in rig operating days was rejected by Mr. Storey, witness for CAODC, who claimed that there had been no significant increase in penetration rate over the previous 8 or 9 years. In addition, Mr. Storey quoted statistics indicating that Alberta's share of Canadian petroleum exploration expenditures had declined from 64 per cent in 1968 to 45.5 per cent in 1970, which, it was argued, indicated the need for exploration incentives in Alberta.

Mr. Storey conceded that the decline in drilling activity could be partially attributable to the lack of discoveries and partially to the decline in areal extent of pools discovered. He claimed that the drilling industry and the oil industry in general required stimulation, and that incentives were needed immediately, especially with regard to the employment aspect.

Gulf stated that it supported the concept of incentives for exploration for oil and gas in Alberta. Gulf endorsed the objectives of the proration plan as discussed by the Board in OGCB Report 64-10, claiming that those objectives are equally realistic today. Gulf agreed that certain measures of exploration activity, such as new field wildcats drilled by Gulf in Alberta had decreased significantly since 1965, and that Gulf land holdings in the Province had decreased somewhat, although much of the latter was due to 'farmed-out' acreage. However, Mr. MacDonald asserted that these data did not indicate that Gulf or other companies were pulling out of Alberta. Mr. MacDonald agreed, under questioning, that Crown land sale income had declined significantly in the last year.

Imperial voiced qualified support for broad incentives for exploration. It declared that the present proration system had been effective in meeting the objectives outlined in OGCB Report 64-10. Imperial further asserted that exploration incentives would only accelerate the rate of finding new reserves, but would not lead to an increase in recoverable reserves which would ultimately be discovered in Alberta. Imperial pointed out that the implementation of such incentives would not increase Alberta's total production rate in the near term, as this is controlled by market demand. It contended that the anticipated increased demand for Alberta crude would cause allowables to increase under the existing plan to the level where incentives to explore would occur.

Imperial estimated that the market demand for Alberta crude oil would surpass productive capacity in the period 1975 to 1977, and that prorating among pools, as we know it today, would then no longer exist, thus obviating the need for specific exploration incentives through the proration plan.

Mr. Peterson, witness for Imperial, agreed that the number of new field wildcat wells drilled in Alberta had declined in recent years, but contended that the major reason for this decline was the lack of success. Mr. Peterson repeated this reason as the basis for Imperial's reduction in new field wildcat drilling and land holdings in Alberta since 1966.

Mobil generally supported incentives for exploration, but contended they were not really necessary under the present reserves-based proration system because the present system encourages both the discovery of new reserves and the maximum recovery of reserves which have already been found. Mobil believed that any additional incentives should be consistent with the objectives of the proration plan.

Mobil agreed that the number of new field wildcat wells which it drilled in Alberta had declined from 1967 to 1970, but claimed that the major reason for this decline was the discouraging rate of discovery.

Others - ARCO, Chevron, Dome and Home claimed that incentives for exploration were needed. CPA, Shell, Union Oil and Western Decalta intervened in support of the IPAC application, but led no evidence as to the need for incentives for exploration.

Exploration Statistics

IPAC and CAODC presented some statistics related to drilling and exploration activity in the Province during recent years. However, in the Board's view, these did not provide a comprehensive appraisal of all relevant trends, and for this reason the Board has assembled more detailed data covering a number of aspects of drilling and exploration activity in Alberta over the past decade. These statistics are presented and discussed in the following section. Board data have been used as the principal source, but where other sources have been used, they have been appropriately identified.

Overall Drilling Activity

Data relative to overall drilling activity in Alberta are presented in Figures IV-1 to IV-6.

Figure IV-1 presents the trends of the past decade in the number of wells drilled annually in the exploratory, development, and total categories. The Lahee system of classification of wells (see Appendix A) was used for this figure and subsequent analyses.

With respect to total wells drilled, the trend of the past decade exhibits only modest year to year changes, and little overall trend. Over the 1968-71 period there has been a relatively constant rate of drilling of some 1,900 wells per year.

The relative stability of the curve of total wells drilled reflects compensating trends within the development and exploratory components. The annual number of development wells drilled has decreased from some 1,100 per year, in the 1962-65 period, to around 825 per year in the 1966-70 period, increasing to approximately 950 wells in 1971. These movements are discussed further in Section V.

Exploratory wells drilled increased markedly from 500 in 1962, to a level of 800-900 per year during 1965-67, increasing further to over 1,000 in 1968, a level which has been maintained through 1971. The heightened activity during the 1965-69 period can be attributed to the Rainbow and Zama exploration plays, and the sustained drilling activity during 1970 and 1971 is most probably a result of exploration for gas in southeastern Alberta and in the Marten Hills-Calling Lake area, north and east of Lesser Slave Lake.

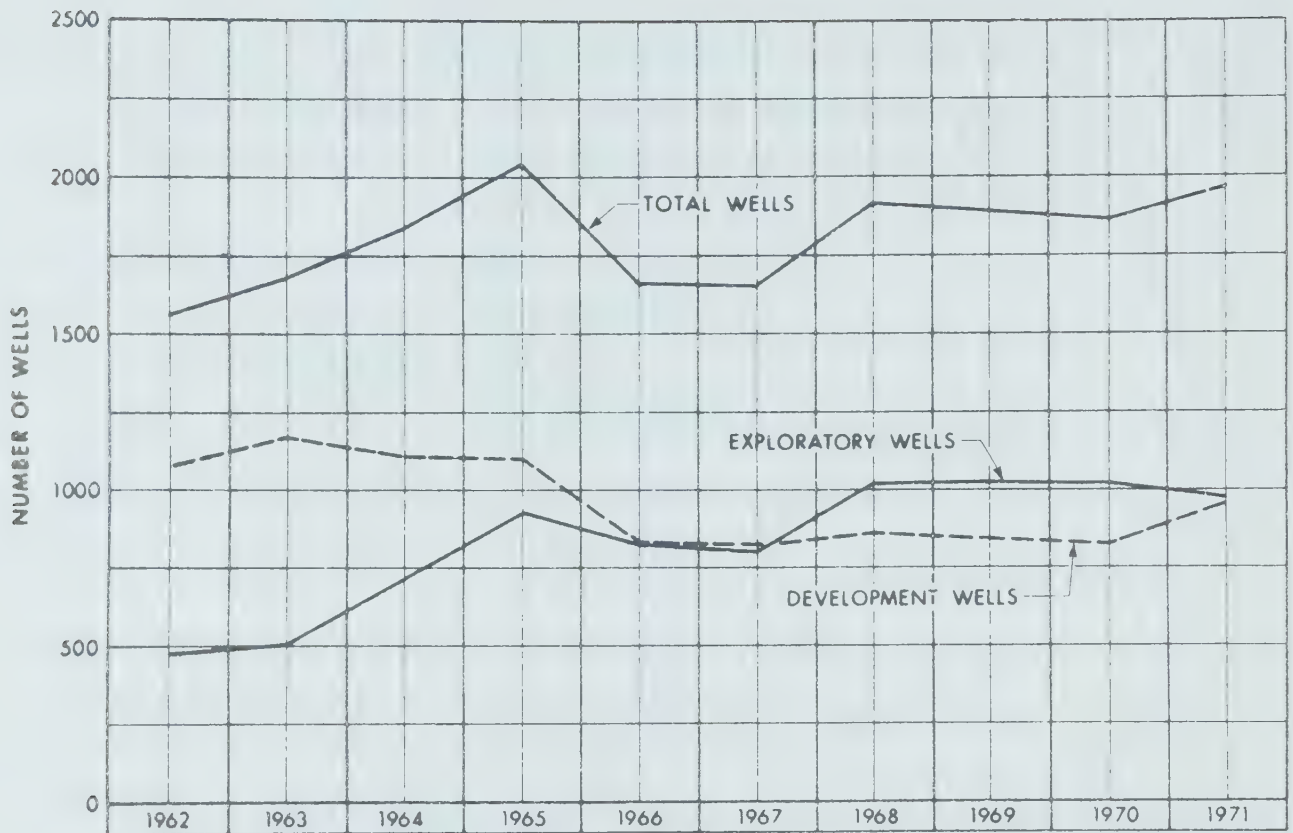


FIGURE IV - 1 - WELLS DRILLED

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Figure IV-2, illustrating the trends in average well depth for exploratory and development drilling, is similarly the result of a combination of many compensating effects. Both curves exhibit fairly consistent declines over the decade, with average exploratory depth declining by 23 per cent from 5,700 feet to 4,400 feet, and average development well depth declining by 38 per cent from 5,900 feet to 3,600 feet.

Both curves are believed to reflect a gradual transition in area of interest from western and northwestern Alberta to the east and southeast of the Province, with the high incidence of drilling for shallow gas production in southeastern Alberta contributing to the relatively steep declines during 1970 and 1971. In addition, renewed interest in drilling for heavy crude oil in eastern Alberta has augmented the decline of the past two years.

A further factor believed to affect the average depth curve for development wells during the period 1965-67 is the PSU concept which came into play during that time. The adoption of PSU regulations allowed for a reduction in the number of development wells drilled, and such a reduction would be most attractive where development wells are most expensive, in the deeper pools.

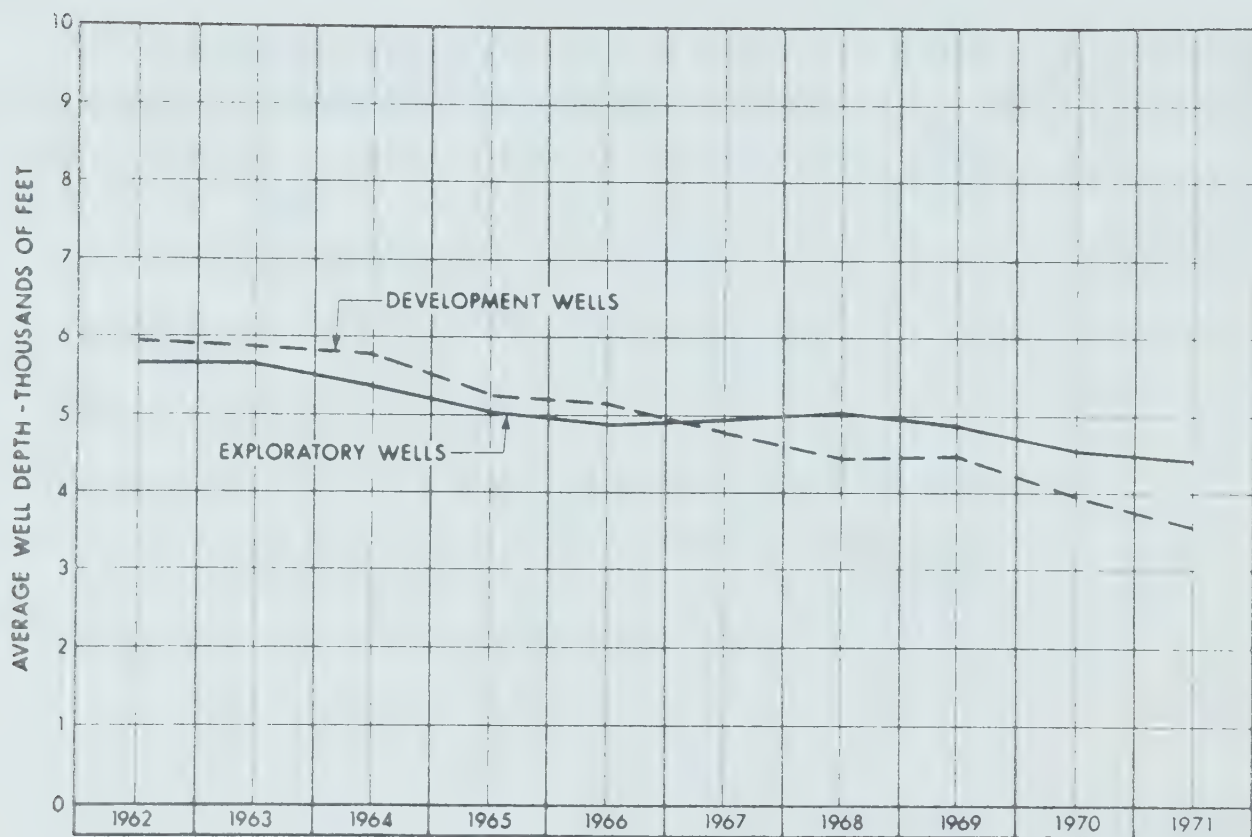


FIGURE IV -2 - AVERAGE WELL DEPTH

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Figure IV-3 presents the total, exploratory and development footage drilled in Alberta over the past decade. These curves reflect the trends in wells drilled and average well depth.

Total footage drilled per year has declined during the decade from levels of 9-10 million feet in the period 1962-65, to some 7.6 million feet in 1971. This is largely due to the decline in the average depth of wells from some 5,800 feet in 1962-63, to approximately 3,900 feet in 1970-71.

The annual footage of exploratory drilling has increased over the decade from some 2.8 million feet in 1962, to approximately 4.2 million feet in 1971. The two peaks of 4.7 million feet in 1965 and 5.1 million feet in 1968 represent the heightened activity of the initial Rainbow play, and the large number of Zama Keg River and southeastern Alberta exploratory wells, respectively. The decline of the last three years reflects the trend to shallower drilling.

The decline in development footage is a consequence of the declines in number of wells and average depth as mentioned previously.

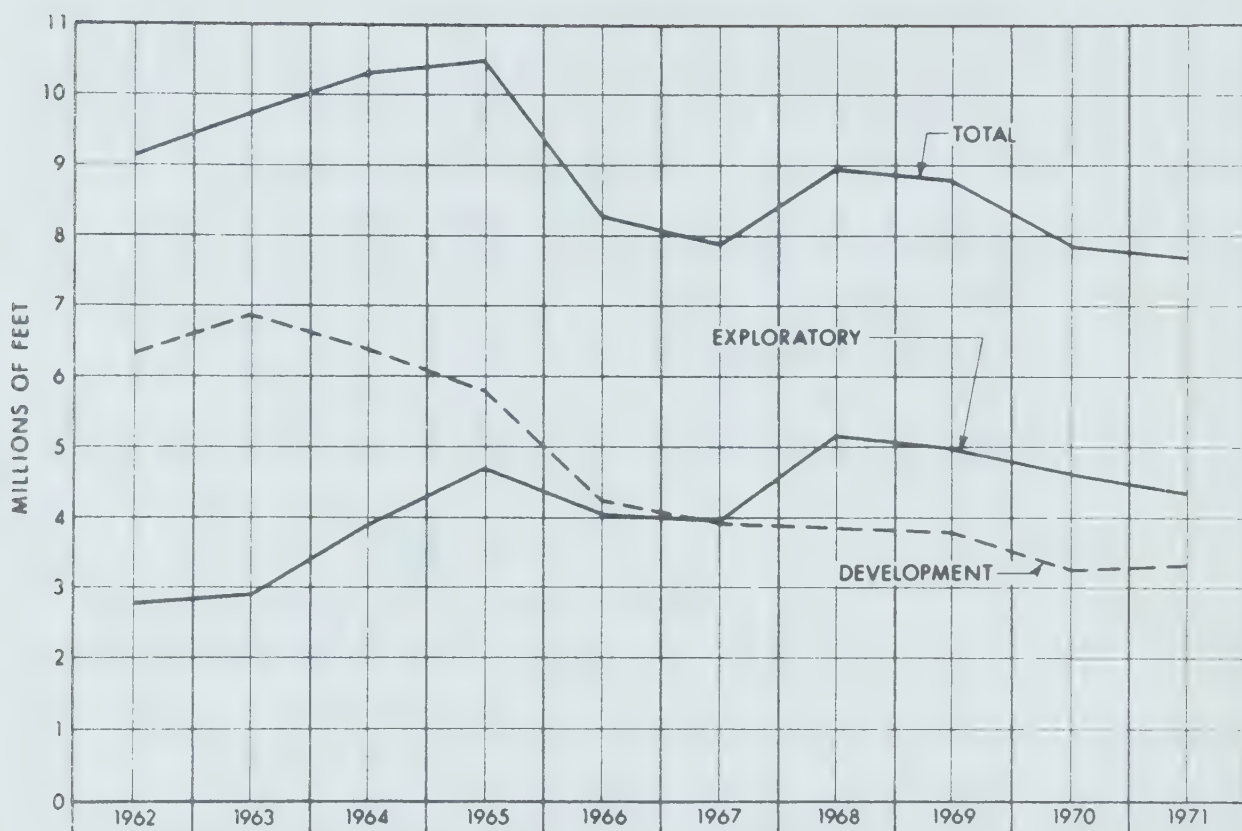


FIGURE IV - 3 - FOOTAGE DRILLED

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In order to obtain an appreciation of exploratory and development effort related to crude oil, the Board has made estimates of the number of "oil-intent" and "gas-intent" exploratory and development wells. The methodology was to determine the number of successful oil and gas wells in the two categories, and subdivide the number of wells drilled in the same proportion for each year's activity. This process of estimation was necessary as the operator's intent is not announced when a well is licensed. This estimation method has the effect of assuming that success ratios for oil and gas exploration in any one year are identical.

Figure IV-4 presents the trend in the number of oil-intent wells drilled over the period 1962-71 in the exploratory and development categories, and the exploratory wells as a percentage of total oil-intent wells.

Exploratory oil-intent wells increased from some 200 in 1962 to a peak of some 600 in 1968, declining sharply thereafter to 250 in 1971. Oil-intent development wells remained constant at around 900 wells per year through 1965, and then declined steadily to a 1971 level of some 300 wells. The combination of these trends as expressed in the curve of oil exploratory activity as a per cent of total oil-intent wells devoted to exploration, shows a consistent increase in this indicator from 15 per cent in 1962 to over 50 per cent in 1969, followed by a modest decline to some 40 per cent in 1971. Factors influencing the decrease in oil-intent exploration activity since 1969 include reduced oil finding success, an increased emphasis on gas exploration, a reduction in the amount of drilling in the Rainbow-Zama area, and the emergence of more attractive exploration areas outside of Alberta.

The Board believes that a breakdown into oil and gas exploration is necessary to assess the trends shown by the total figures, but recognizes that the method of determining oil-intent and gas-intent may be inaccurate, and in particular may understate the number of oil-intent wells drilled in recent years.

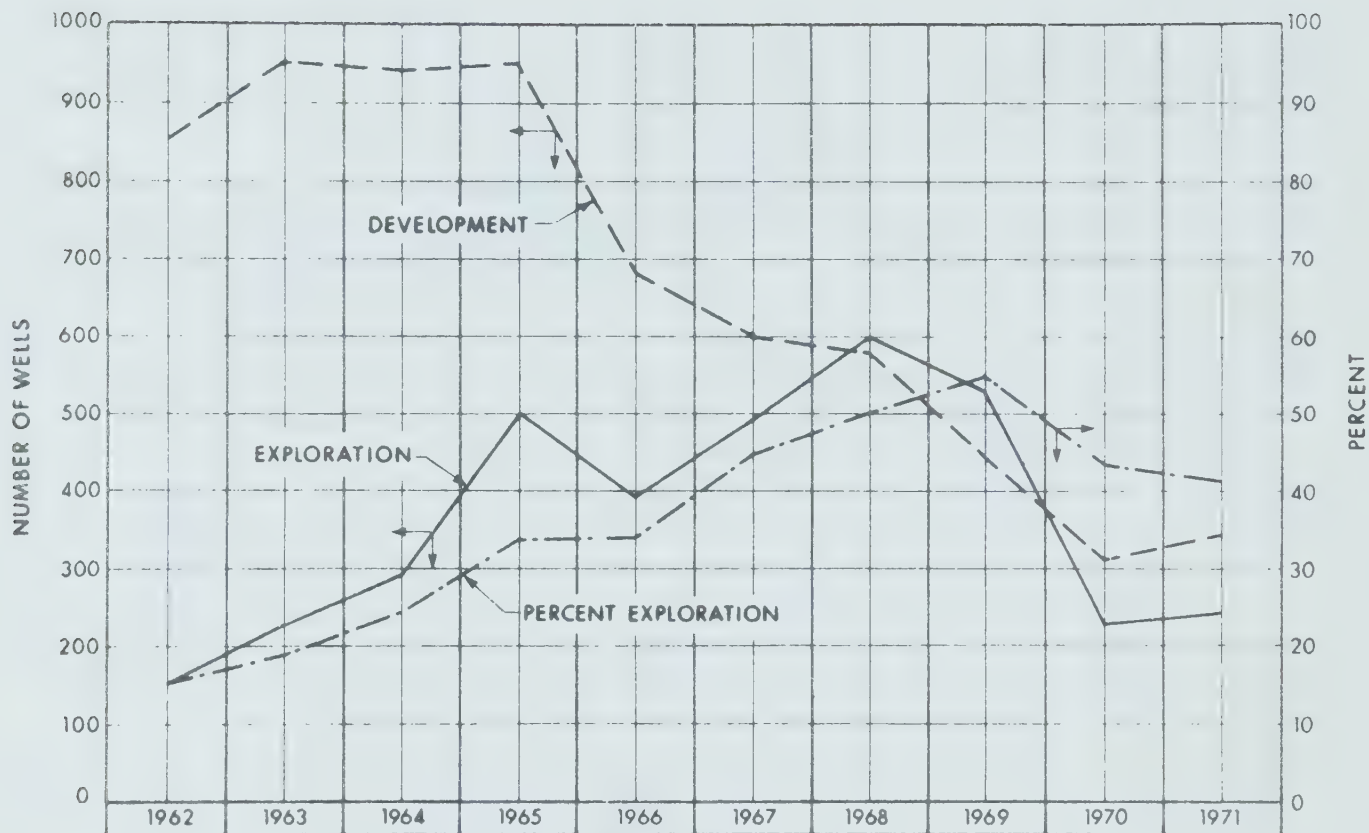


FIGURE IV - 4 - WELLS DRILLED WITH OIL INTENT

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Figure IV-5 is a companion plot to Figure IV-4, presenting the breakdown between exploratory and development wells drilled with gas-intent, and the percentage of total gas-intent wells devoted to exploration over the decade. Annual gas-intent exploratory wells remained relatively constant in the range of 300-400 wells during the period 1962-67, and increased thereafter to a 1971 level of 750 wells. Gas-intent development wells exhibited a similar pattern, remaining at 200 wells per year over the 1962-67 period, and increasing thereafter to a 1971 level of some 600 wells. The long term trend in exploratory gas-intent drilling as a per cent of total gas-intent drilling has remained relatively constant at approximately 60 per cent.

The identified increase in gas-intent drilling activity corresponds to a period of increased markets for natural gas and some improvement in wellhead prices.

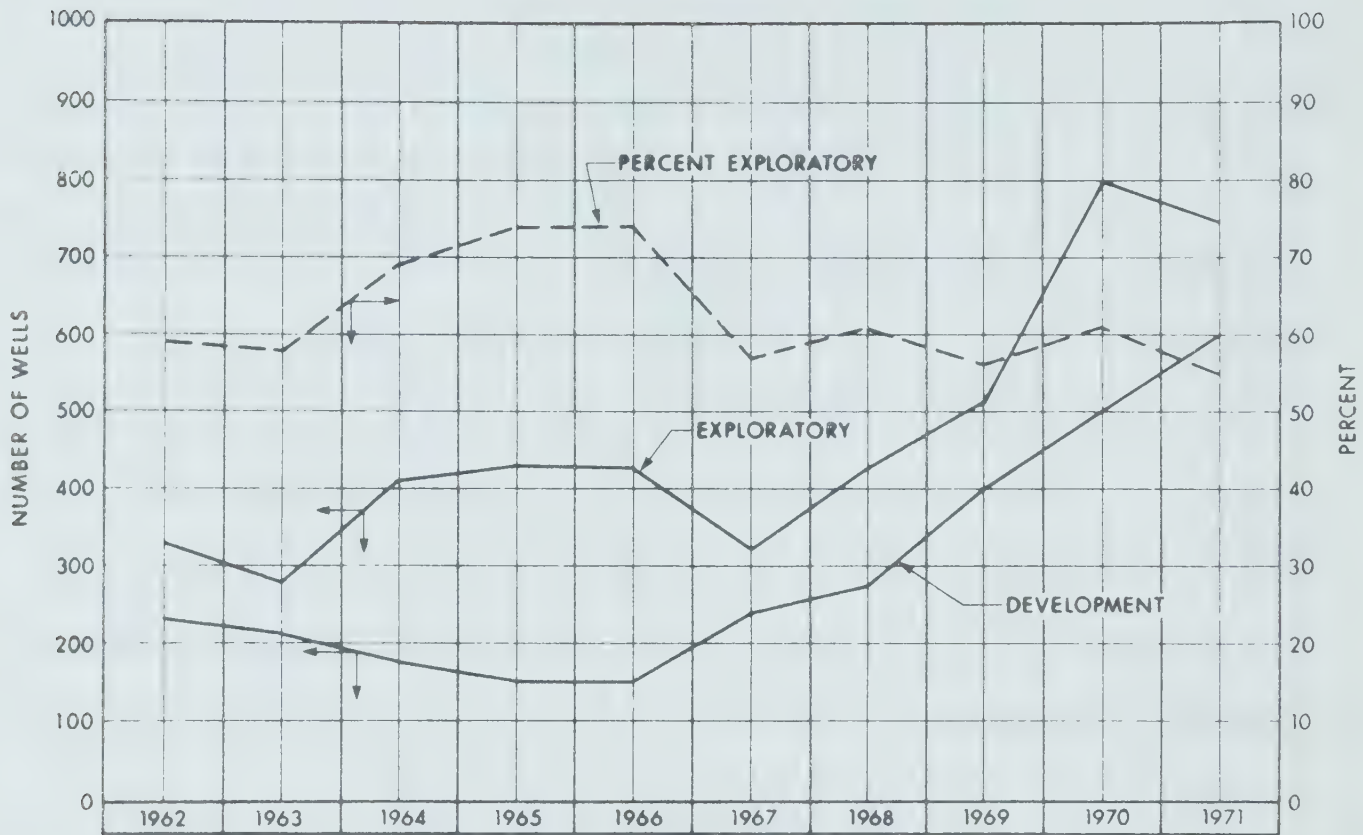


FIGURE IV - 5 - WELLS DRILLED WITH GAS INTENT

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Figure IV-6 illustrates the trend in total rig operating days within Alberta. Data for the 1968-71 period were supplied by CAODC, while the Board staff has estimated rig operating days for the previous years by applying the average footage per day for the 1968-70 period to the total footage drilled per year. The use of the 1968-70 average penetration rate is supported by the statement of the CAODC witness at the hearing that there had been no technological advances which had improved the rate of penetration over the previous 8 or 9 years.

The curve shows a long term decline over the period, with peaks of some 40,000 days and 34,000 days in 1965 and 1968 respectively. The decline in rig operating days in 1966 and 1967 was probably a result of the PSU regulations introduced under the proration plan, and the decrease in average well depth as shown in Figure IV-2. These effects were offset in 1968 by an increase in exploratory footage drilled in the Rainbow-Zama and foothills areas of the Province. The more recent decline in rig operating days is attributed to the lack of a major play, and the continued decline in average well depth.

Due to the method of estimation during the 1962-67 period, the curve as illustrated may understate rig operating days, but lacking firm data, the Board believes that the shape and level of the plot is a valid approximation.

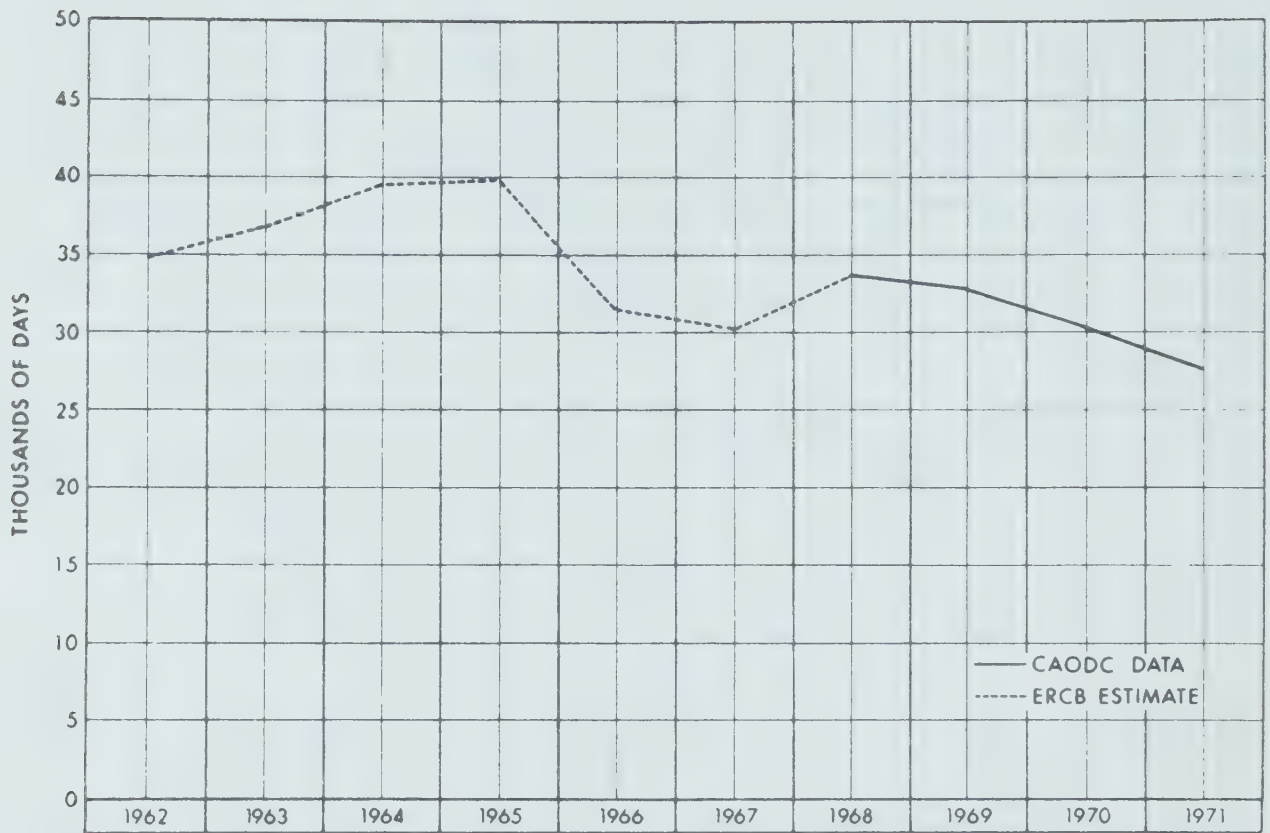


FIGURE IV - 6 - RIG OPERATING DAYS

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Exploratory Drilling Activity

Figure IV-7 plots the exploratory wells drilled since 1962 by Lahee categories of new field wildcat, new pool wildcat, deep pool test, and outpost wells. The overall exploratory trend discussed in connection with Figure IV-1 can be seen to be a consequence of varying trends in each component category.

The number of new field wildcats drilled per year increased from some 350 in 1962 to over 500 in 1965-68. Since 1968 there has been a steady decline to the present level of some 250 wells. Additional analysis, not shown here, revealed that the major reductions in new field wildcats in recent years occurred in the southeastern and northwestern areas of the Province. The former area has been quite intensively explored, and this decline probably relates to diminishing favourable prospects, and the lack of a new geological play. The reduction in the northwestern area since 1969 is directly attributable to the fairly complete level of development attained in the Rainbow-Zama area.

New pool wildcats have increased over the decade from less than 100 in 1962 to over 600 in 1970-71. This substantial increase was caused initially by oil exploratory activity in the Rainbow-Zama area in 1967-69, followed by gas exploration in the southeast and eastern areas of the Province. In these latter two areas, gas exploration programs have related to certain Cretaceous formations that are characterized by a multiplicity of small pools having limited areal extent. As a consequence many of these exploratory wells, being located in areas or environments now known to be productive of hydrocarbons or being located relatively close to at least one small pool, were classified as new pool wildcats.

Outpost wells increased from 40 in 1962 to some 200 in 1965, declining to 60 in 1969 and remaining essentially at that level thereafter.

Deeper pool tests have remained virtually constant over the decade averaging some 20-30 wells per year.

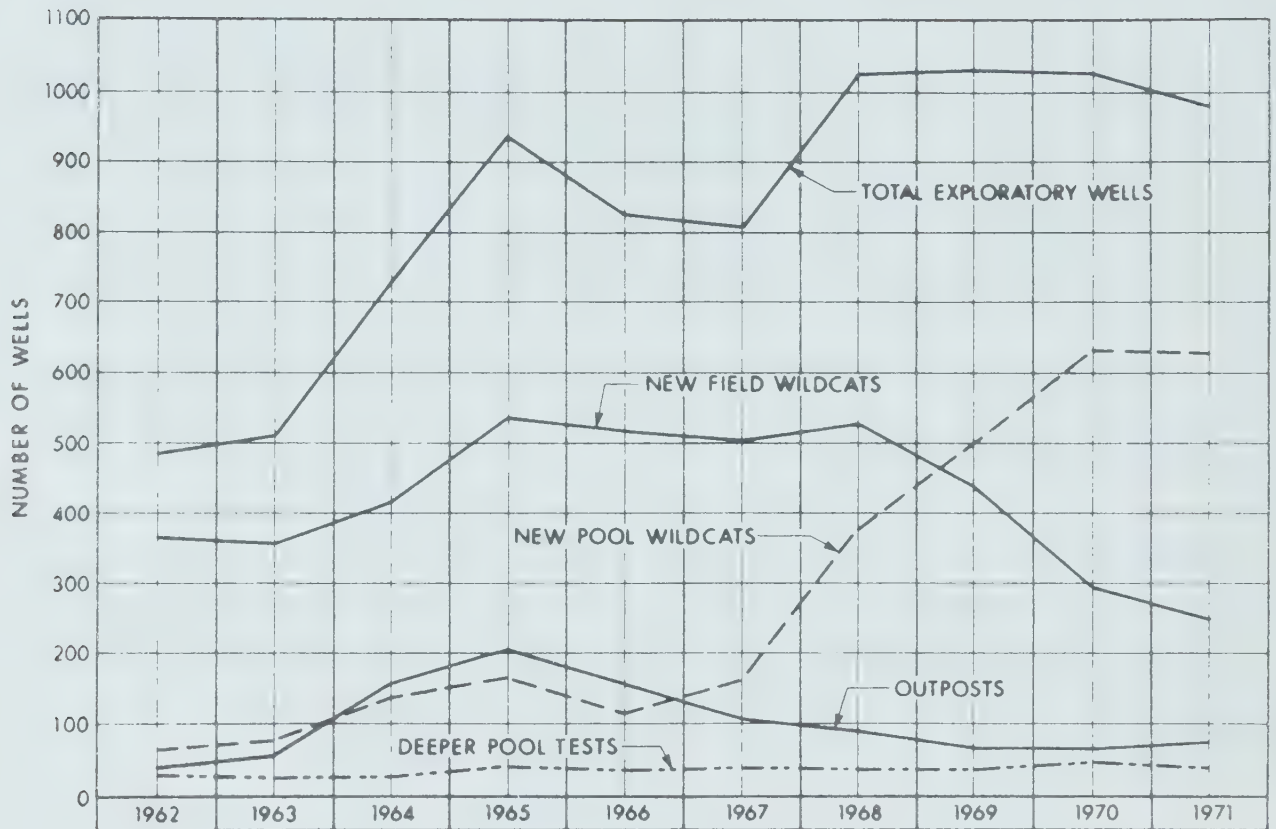


FIGURE IV - 7 - EXPLORATORY WELLS DRILLED BY LAHEE CLASSIFICATION

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At the public hearing on the IPAC proposal reference was made to differing types of operators, and a possible dichotomy of those companies who are largely Alberta oriented, and those to whom Alberta is but one component within a wider scale of operations. The Board believes it is useful to examine drilling activity under the categories "Major" and "Minor" operators. For this purpose the Board rather arbitrarily selected ten of the larger operators in the Province who are associated with integrated international companies, while all other companies, totalling over 200, were classified as minor operators (see Appendix B). While recognizing that several operators classified as minor have international ties, the Board has arbitrarily assumed that their Alberta activities represent a larger proportion of their total operations than those of major operators. The terms major and minor are convenient ones, and are in no way intended to reflect on the importance or contribution to the Alberta oil industry.

Statistics on the number of exploratory wells drilled by major and minor operators (the well licensee was assumed to be the operator) between 1962 and 1971 are presented in Figure IV-8. The data indicate a substantial upward trend in the number of exploratory wells drilled by minor operators, from some 370 wells in 1962 to 900 in recent years. The number of exploratory wells drilled by major operators has remained relatively constant over the decade, increasing from just over 100 in 1962 to some 250 in the 1965-68 period, and declining thereafter to a 1971 level of 75. The 1968-71 movements in the component curves largely offset each other, resulting in the total number of exploratory wells remaining virtually constant at around 1,000 per year over this period.

The Board has further analyzed the major-minor breakdown on a geographical basis within Alberta, to identify any divergent trends. In the southeastern portion of the Province exploratory drilling has historically been dominated by the 200 or more minor operators, and while the activity of the ten major operators has declined over the decade, minor operators' drilling has increased significantly. In the foothills area of Alberta there are no apparent divergent trends, and in the Rainbow-Zama

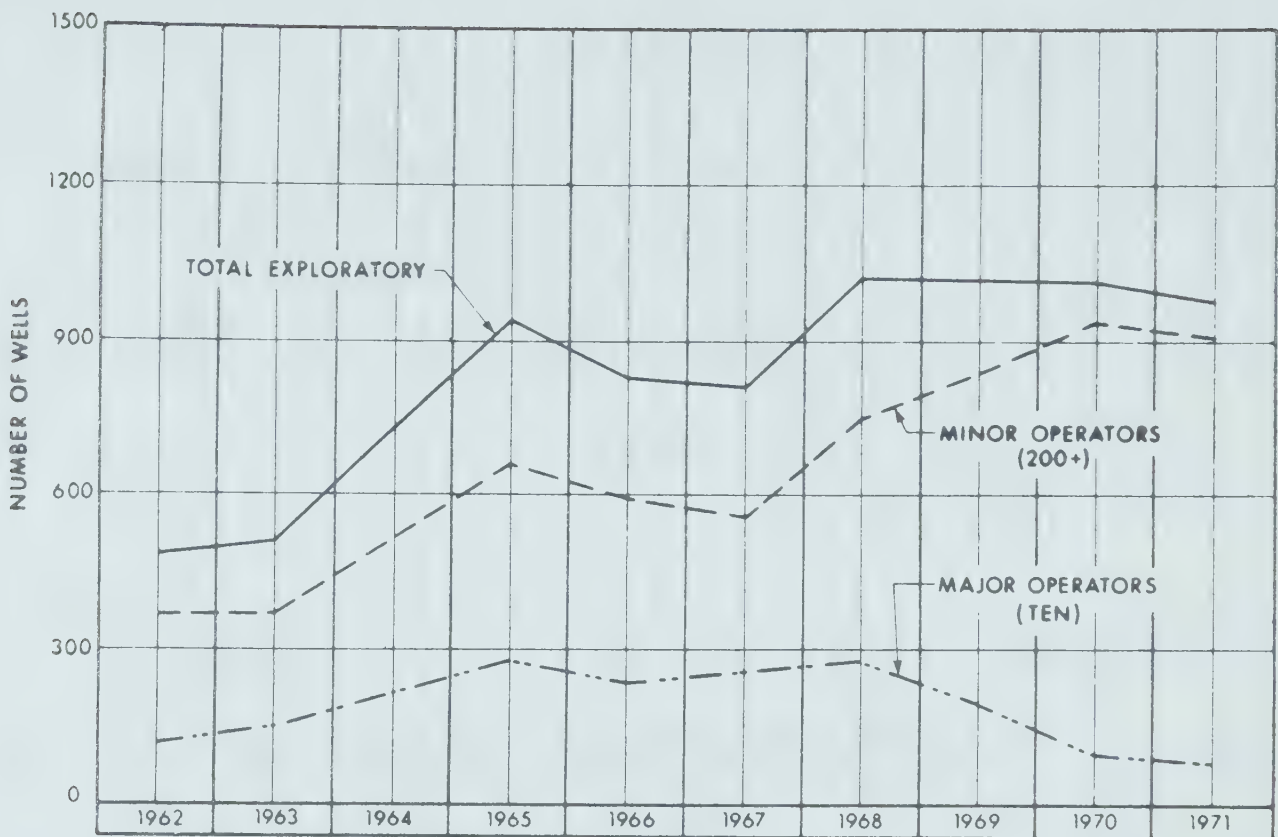


FIGURE IV - 8 -- EXPLORATORY WELLS DRILLED BY OPERATOR CLASSIFICATION

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region the trends are very similar with a somewhat greater residual interest in the past two years shown by the minor operators. In the central and northeastern area of the Province the statistics reveal similar variation during the 1962-68 period, although over the past three years there has been a divergent trend, with major operators reducing activity, while minor operators have increased exploratory effort.

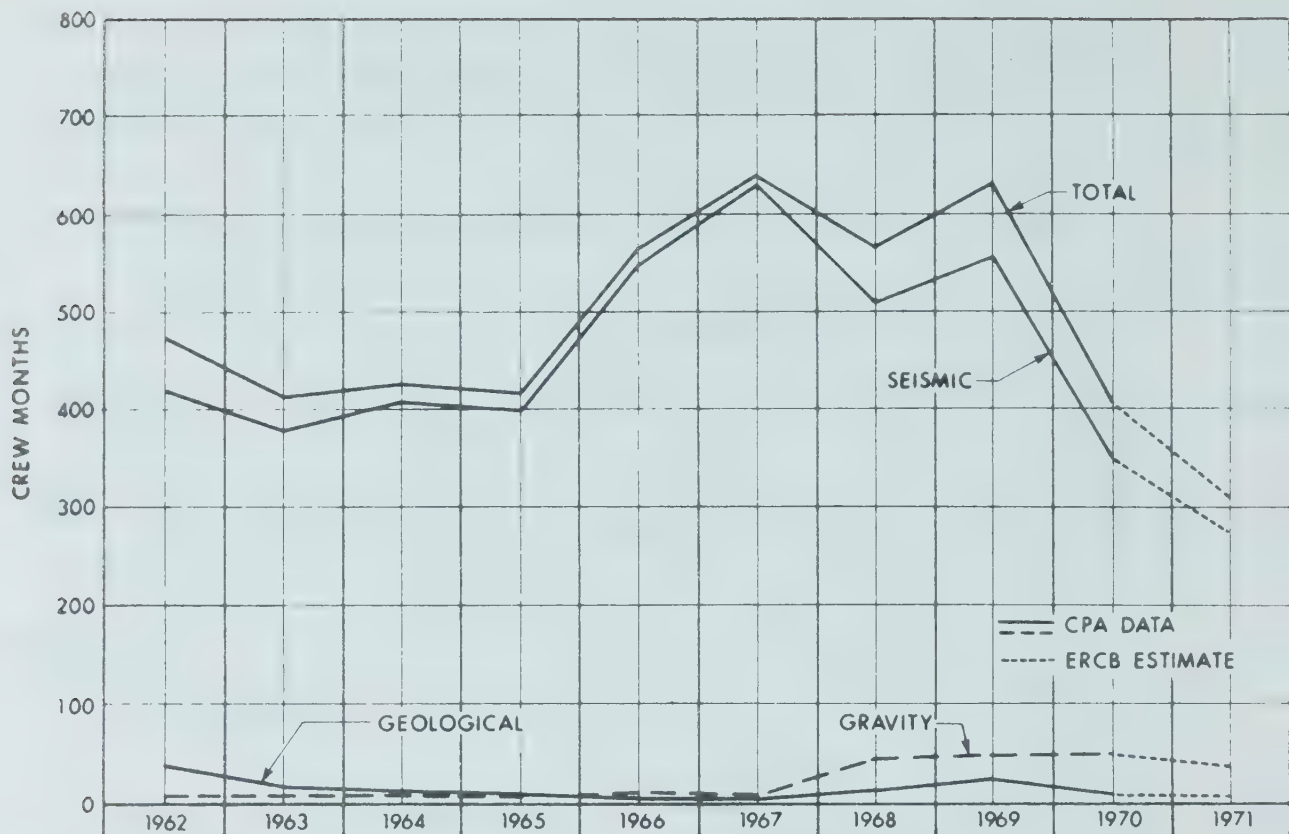


FIGURE IV - 9 - SURVEY CREW ACTIVITY

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Figure IV-9 shows the trend of survey crew activity in Alberta over the past decade. 1962-70 data were obtained from the CPA, while 1971 statistics were estimated by the Board staff. Total survey crew activity over the decade exhibits three phases. During 1962-65 total survey effort per year remained relatively constant at around 420 crew months. Due principally to the Rainbow-Zama play, activity increased significantly over the 1966-69 period, reaching a peak of some 630 crew months in 1967. A third phase is apparent during 1970-71, with a sharp decline in activity to an estimated 310 crew months in 1971. The 1970-71 trend can be attributed to the decline in crude oil discoveries and to the increased exploration of the Lower Cretaceous zone of south-eastern Alberta where seismic work is of limited value.

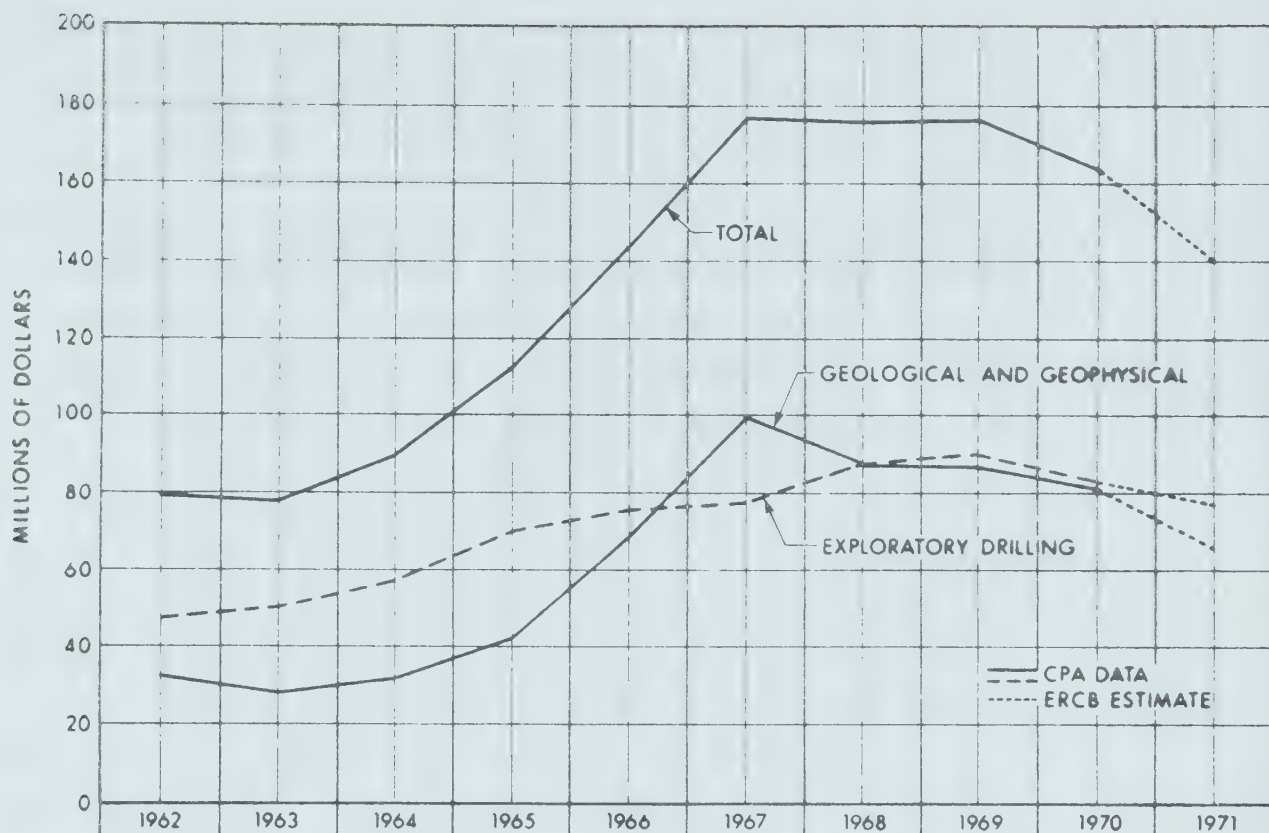


FIGURE IV - 10 - EXPLORATION EXPENDITURES

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Figure IV-10 presents the trend over the past decade in geological, geophysical, and exploratory drilling expenditures. CPA data have been used for 1962-70, with 1971 data estimated by the Board staff.

Total expenditures increased by significant amounts over the early years of the period, reaching \$177 million in 1967, remained relatively constant between 1967 and 1969, thereafter declining to a 1971 level of \$140 million. Factors influencing the decline in exploration drilling costs in 1970-71 include the decrease in exploratory footage drilled, the decline in average exploratory well depth, and the type of exploration drilling which occurred.

Figure IV-11 presents data relating to land acquisition and rental expenditures. 1962-70 data were obtained from the CPA, while the 1971 statistics were estimated by the Board staff largely on the basis of information obtained from the Alberta Department of Mines and Minerals. CPA data include expenditures for Crown land sales and the total expenditures for land acquisition and rentals. The rental expenditures were determined by subtracting the expenditures for Crown land sales and bonuses from total expenditures for land acquisition and rentals. As a result the rental data include all payments to freehold owners.

Annual expenditures for land sales and rentals increased substantially in the early years of the decade rising from \$84 million in 1962 to some \$200 million in 1965. These expenditures remained virtually constant over the 1966-69 period, at some \$170 million, declining thereafter to \$107 million in 1970.

The trends in total expenditures have been significantly influenced by expenditures for Crown lands, which reached a peak of \$140 million in 1965, fluctuated between \$100 million and \$120 million per year during 1966-69, then declined to some \$40 million in 1970-71. The drastic decline in 1970 was largely the result of less money being spent on drilling reservations, P & NG reservations, and P & NG leases.

Over the decade, rental payments have shown a general increase, rising from \$42 million in 1962 to an estimated \$83 million in 1971. During this period rental payments to the Crown have declined from 92 per cent of the total in 1962, to 83 per cent in 1971.

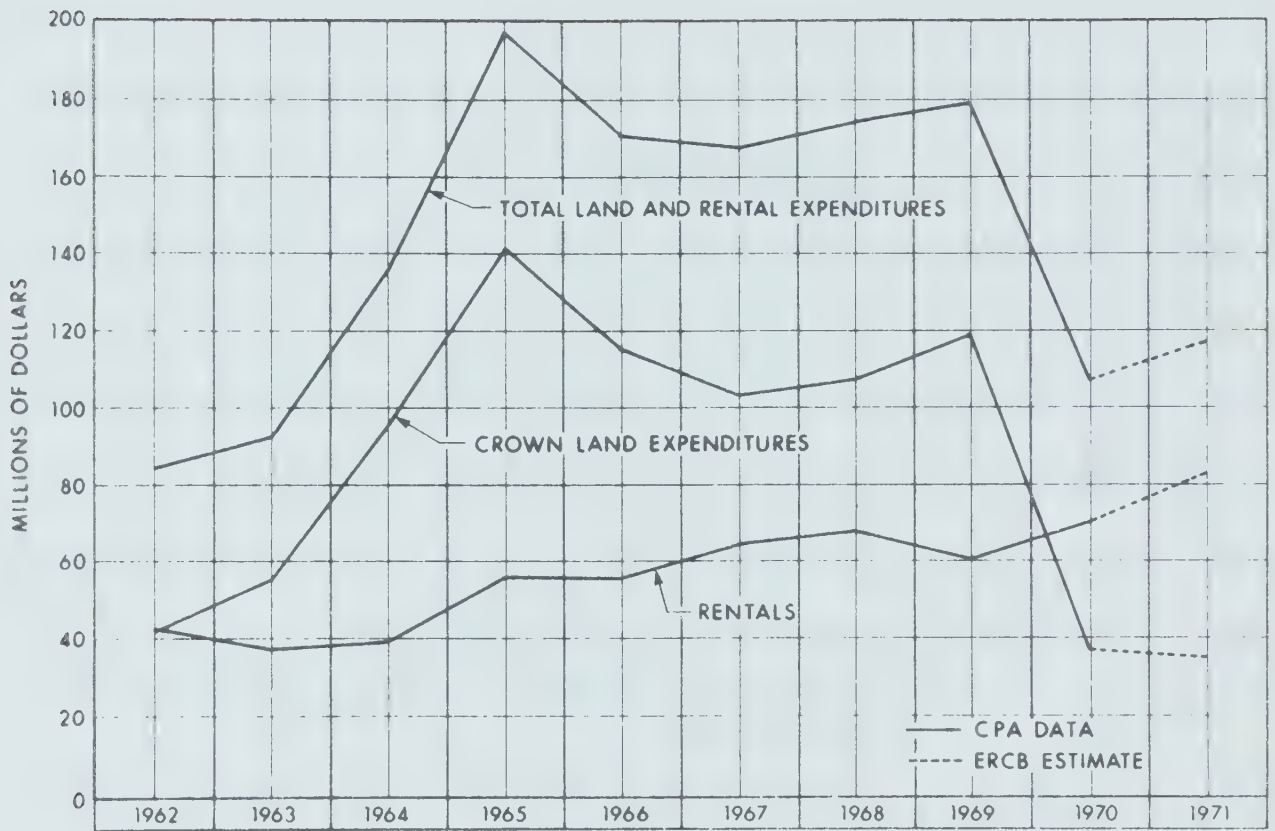


FIGURE IV - 11 - LAND ACQUISITION AND RENTAL EXPENDITURES

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Exploration Results

Figures IV-12, 13, and 14 are intended to illustrate by various groupings the degree of success achieved by exploratory drilling for the period 1962-71.

Figure IV-12 presents oil, gas, and total successful exploratory wells. The trend of total successes is a relatively consistent increase from 140 wells in 1962 to 325 wells in 1971. Oil successes show a steady increase from 40 to 150 wells per year over the 1962-69 period, followed by a sharp drop to 60 wells in 1970, with a slight increase to 80 successes in 1971. Successful gas wells remained at a fairly constant 120 wells per year during 1962-68, followed by a fairly rapid and steady increase to a 1971 level of some 250 wells.

The recent decline in oil successes reflects the lack of a significant oil exploration play, while the steady growth of gas success since 1968 reflects the greater interest in, and intensity of, gas exploration which has been discussed previously.

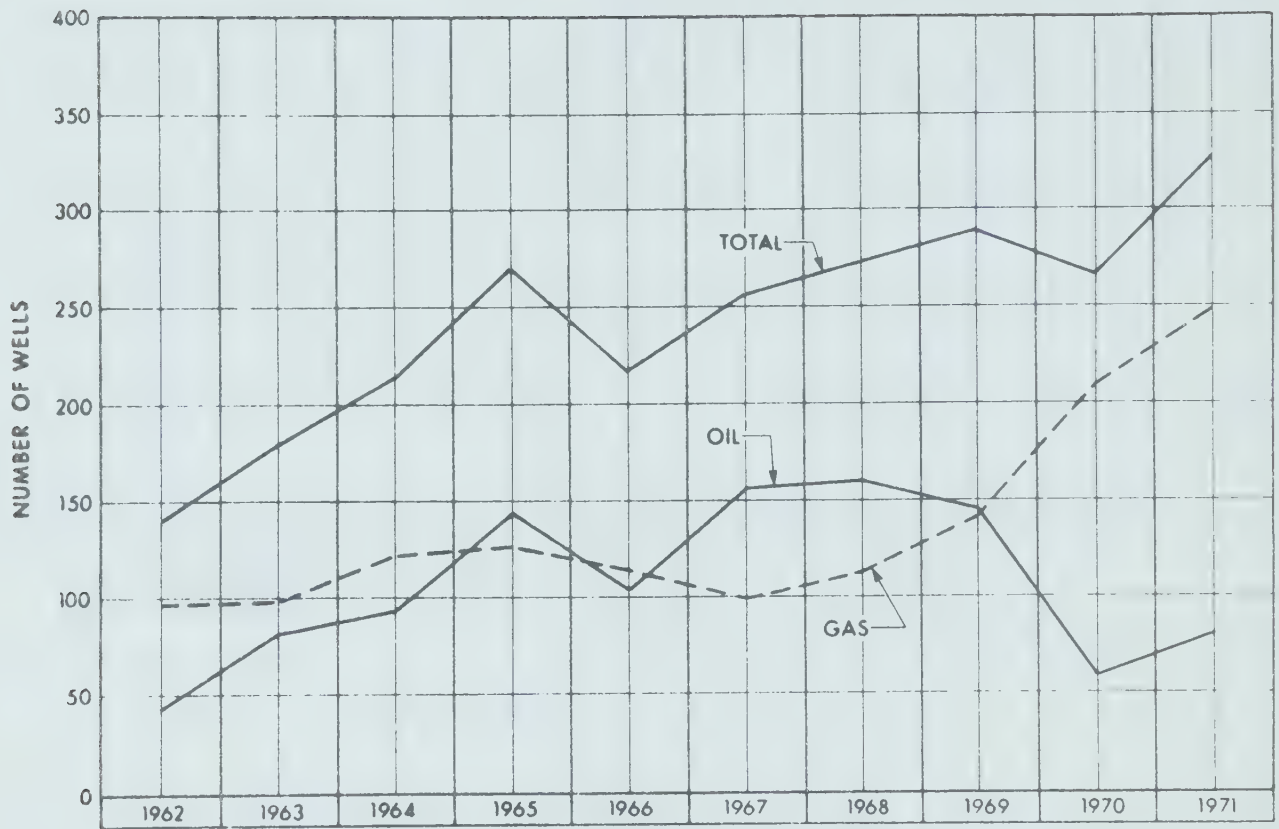


FIGURE IV -12 - SUCCESSFUL EXPLORATORY WELLS

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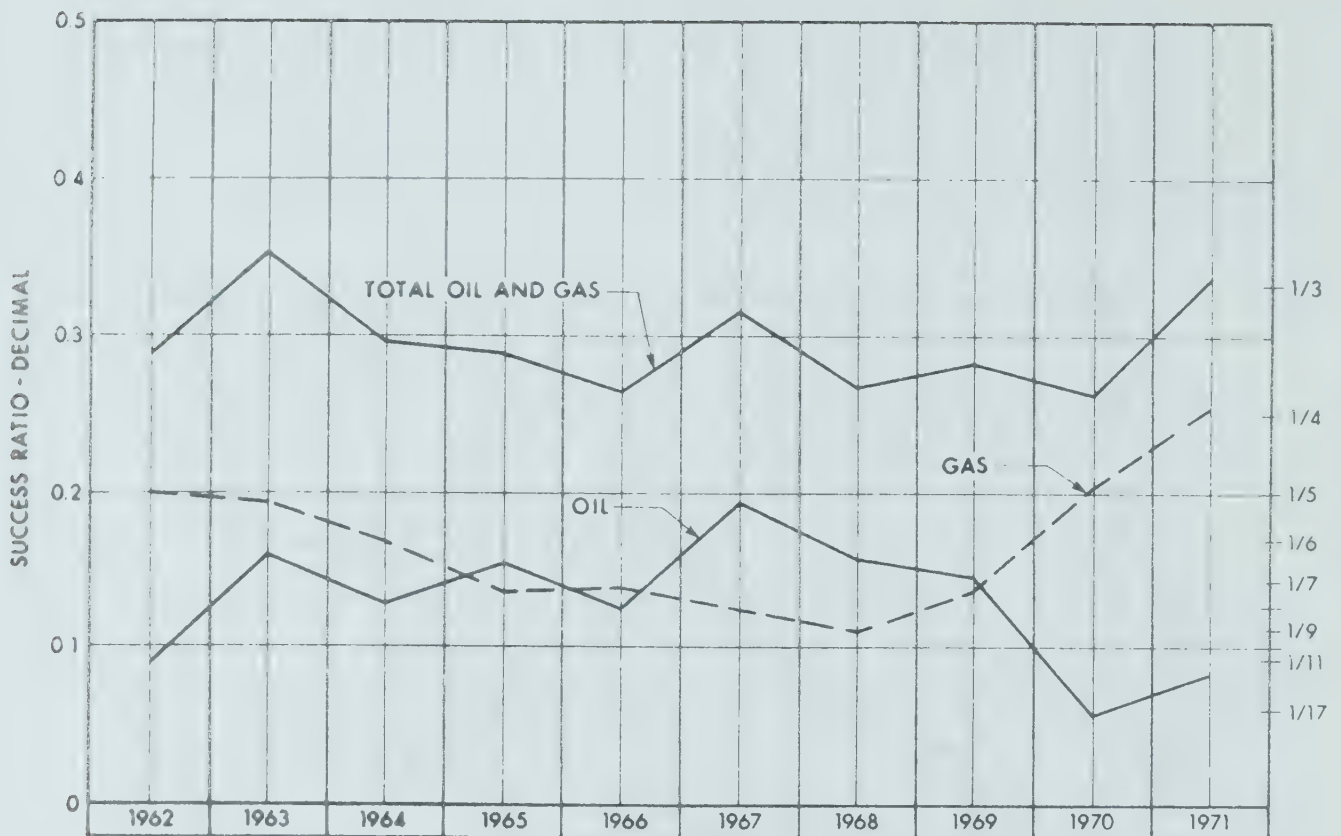


FIGURE IV - 13 - SUCCESSFUL WELLS PER EXPLORATORY WELL

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Figure IV-13 presents successful oil and gas wells on a per exploratory well basis, or success ratio. For oil and gas combined the success ratio has maintained a relatively constant 0.3 level. The oil success ratio paralleled the total curve from 1962-69 at a 0.15 level, peaking at almost 0.2 in 1967 at the height of the Zama exploratory activity. However in 1970 and 1971 there has been a drop in the success ratio to 0.06 and 0.08 respectively. These ratios correspond to approximately one successful oil well per 17 total exploratory wells drilled in 1970 and one success per 12 exploratory wells in 1971. The success ratio for gas wells has followed a different pattern, declining from 0.2 in 1962, to 0.11 in 1968, with a rapid rise in recent years to 0.25 in 1971, reflecting the successful exploratory efforts in the southeastern area of the Province.

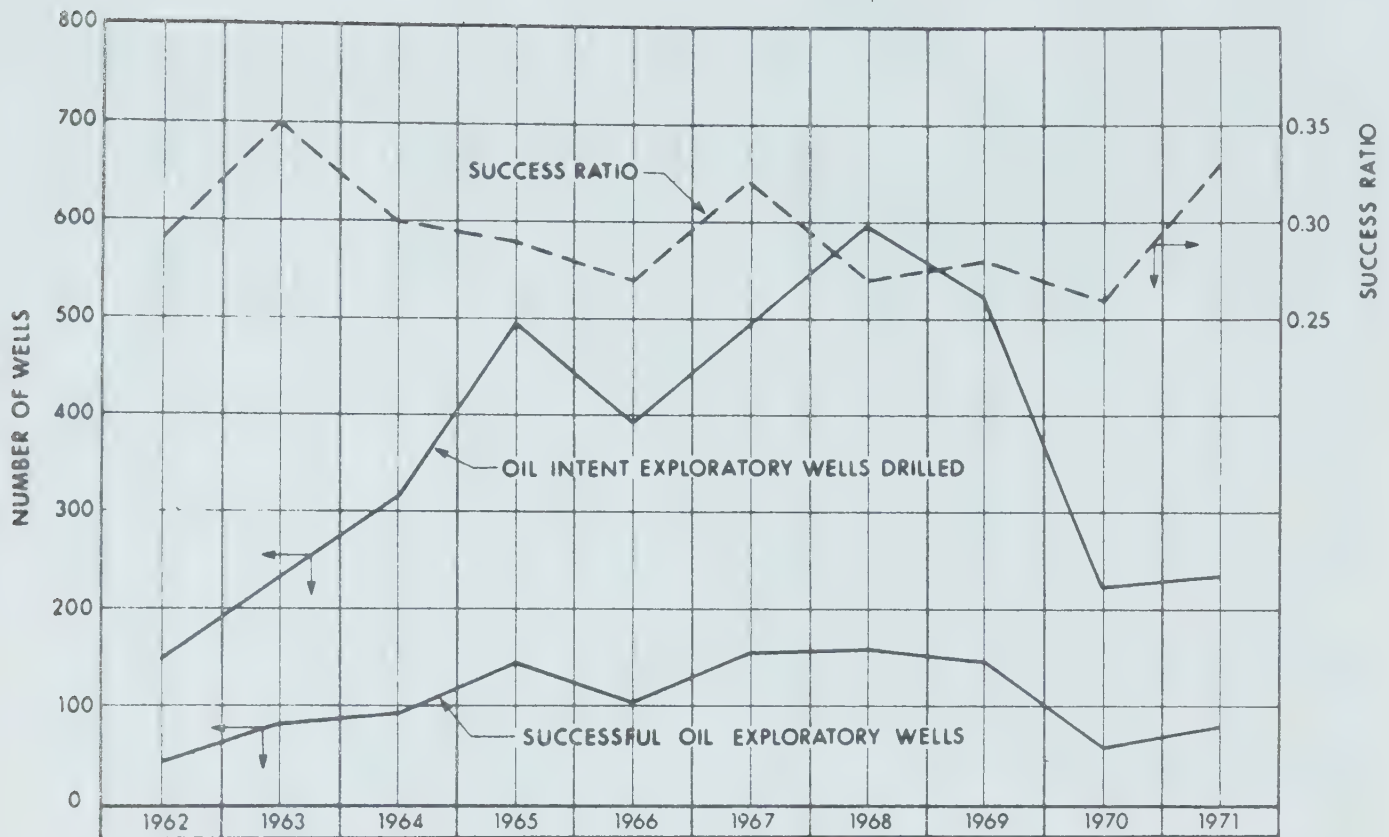


FIGURE IV - 14 - OIL INTENT EXPLORATION AND SUCCESS

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Figure IV-14 presents plots of successful oil exploratory wells, success ratio, and oil-intent exploratory wells drilled (calculated via the methodology described previously in connection with Figure IV-4). Successful oil exploratory wells increased from about 50 in 1962 to some 150 during the 1965-69 period, declining to 60 in 1970, and 80 in 1971. Calculations based on the assumption that the oil success ratio equalled the total success ratio for any given year result in the plot of oil-intent wells, which reveals a rising trend over the 1962-68 period, with a peak of almost 600 wells in 1968, followed by a decline to some 220 wells in 1970 and 1971. The decline in the number of successful oil wells can be largely attributed to this sharp decline in the number of oil-intent wells.

Reserves

Figure IV-15 presents plots of the number of barrels of oil reserves discovered per year, as estimated by the Board, at the end of the discovery year, and at December 31, 1970 (data for 1971 discoveries have been estimated by the Board staff). The plot of reserves estimated at the end of the discovery year shows a consistent increase during the period 1962-68, rising from a very low level to a peak of almost 400 million barrels in 1968, and declining thereafter to 100 million barrels or less in 1970 and 1971. The slope of the curve is indicative of the 1965 discovery of the Nipisi Gilwood A pool, and a number of Rainbow Keg River pools, the continued high discovery rate of Rainbow and Zama Keg River pools in the years 1966-68, and the Board's policy of initial area assignments equal to the DSU size which resulted in artificially large initial reserves estimates for a number of Keg River pools, which were corrected in subsequent years. The sharp decline in later years is related to the limited number of successful oil wells as discussed previously. Other important discoveries, such as the Mitsue Gilwood A Pool in 1964, have not affected the plot significantly, as only relatively small volumes of reserves had been proven by the end of the discovery year.

The dashed curve on Figure IV-15 presents the trend in discoveries by year as estimated at December 31, 1970, that is after crediting reserves additions due to pool extensions, re-assessments and enhanced recovery schemes, back to the discovery year, and the addition of an estimate for 1971 discoveries. The high levels of additions in the years 1964-66 result from the major discoveries in Mitsue, Nipisi, and Rainbow-Zama areas, with a peak value in 1965 of some 600 million barrels. The decline in later years is due to both the decline in discoveries and downward revisions in many pools discovered in the 1967-69 period, particularly those in the Rainbow-Zama area which have characteristically been found to be much smaller than initially estimated, and much smaller than the DSU size. It should be noted that the reserves data of pools discovered in recent years, having had less time to exhibit

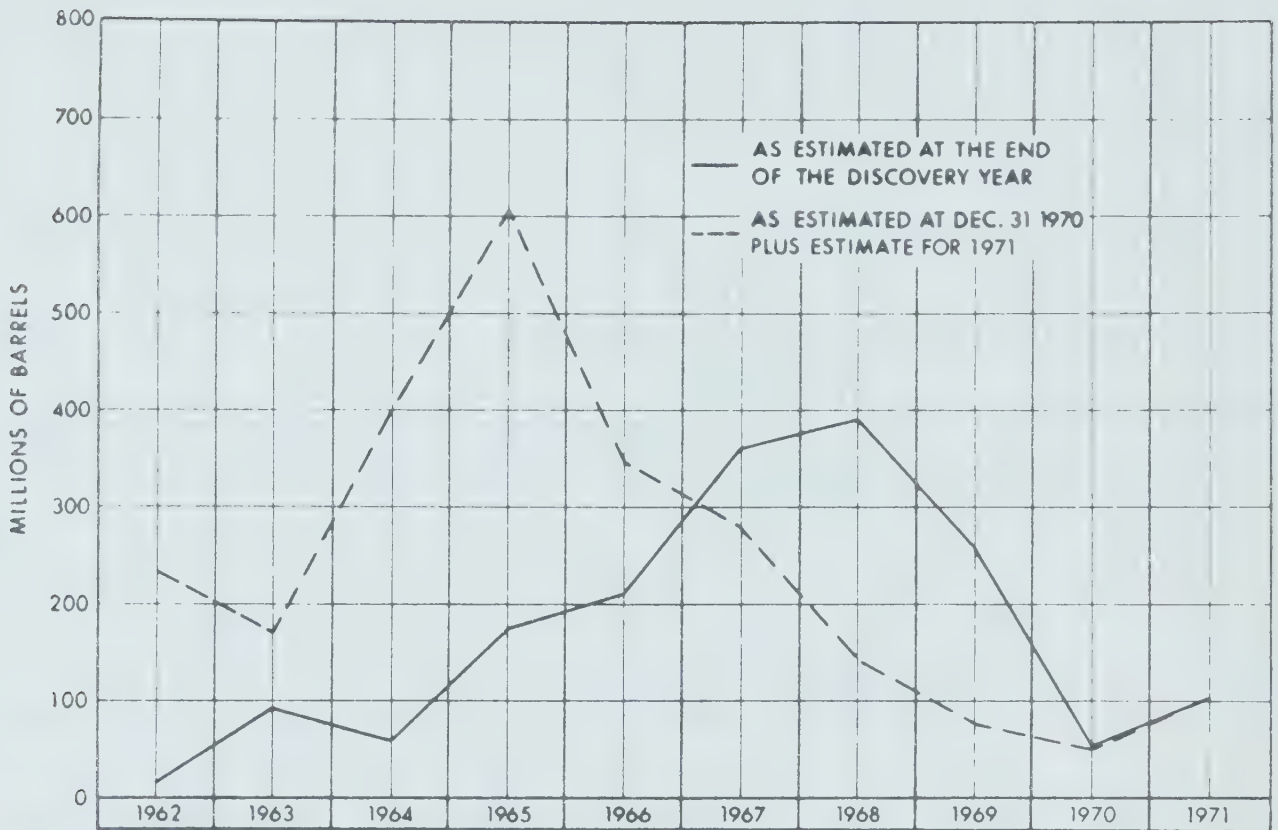


FIGURE IV - 15 - OIL RESERVES DISCOVERED

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growth due to revisions and enhanced recovery, may later be increased after completion of evaluation, and therefore the downward trend may ultimately be less steep than now shown.

IPAC presented data on discoveries, which are reproduced in Section IV (1). Although IPAC did not provide its definition of the term, the data plot fairly closely to the Board's dashed curve on Figure IV-15.

Finding Rate

The Board staff has further analyzed reserve discoveries, by calculating discoveries per exploratory well, and these plots are presented in Figure IV-16. The reserves estimate used was that of December 31, 1970, plus an estimate for 1971. The lower curve is based on total exploratory wells, the other on the estimated oil-intent exploratory wells. The limitations regarding the reserves and oil-intent estimates have been discussed previously. The curve of reserves discovered per (total) exploratory well shows a declining long term trend over the period from 480,000 barrels in 1962 to some 50,000 barrels in 1970, with a significant peak in the finding rate during the years 1964-66 with a maximum value of 650,000 barrels per well in 1965. The pattern is broadly similar for reserves discovered per oil-intent exploratory well although the scale of variation is greater and the overall level is higher. 1971 data indicate upturns in both curves.

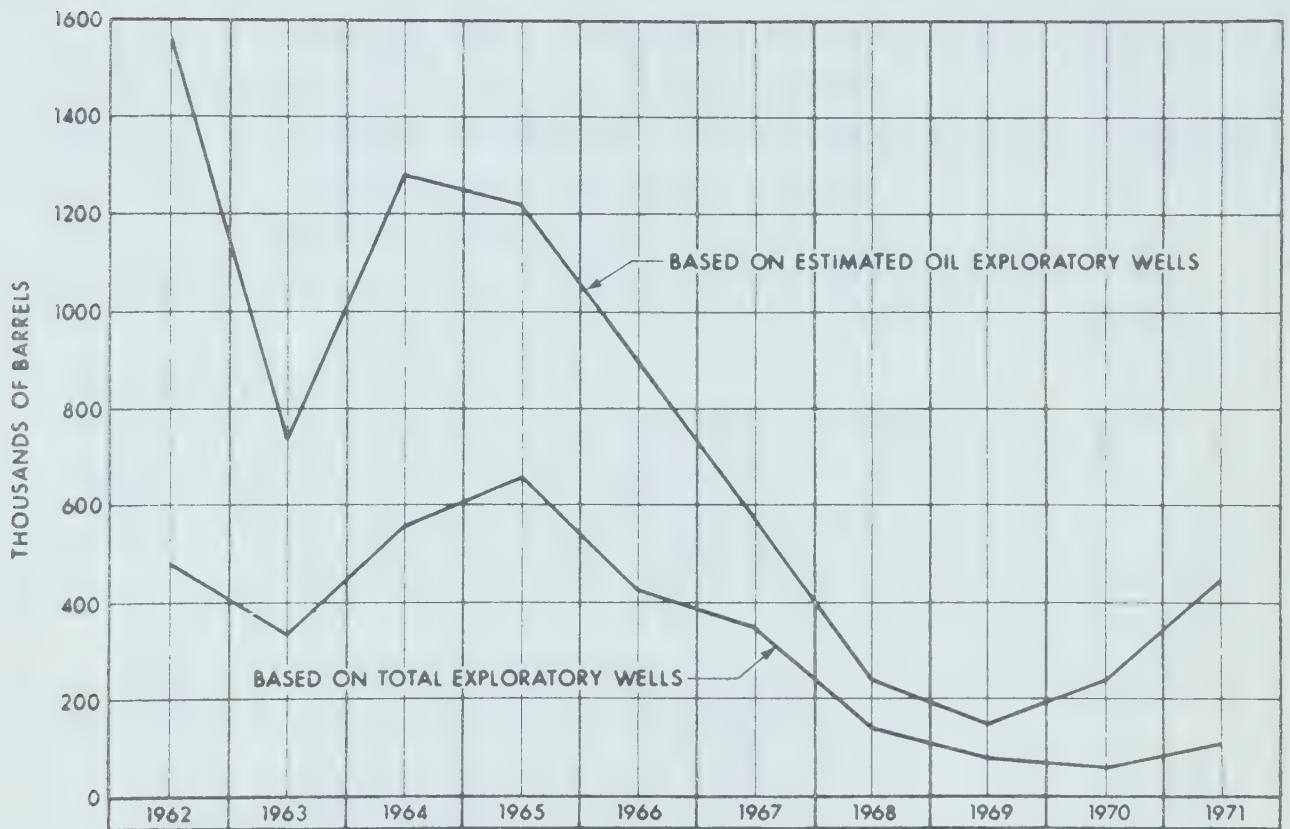


FIGURE IV - 16 - RESERVES DISCOVERED* PER EXPLORATORY WELL

*ESTIMATED AT DEC. 31, 1970

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(3) Views of the Board

The record of exploration activity and results over the 1962 to 1971 period may be summarized as follows:

Activity

1. The total number of exploratory wells drilled per year has nearly doubled over the decade although it has remained essentially constant over the past four years.
2. Over the period 1962 to 1967 new field wildcats represented about 65 per cent of all exploratory wells drilled and new pool wildcats about 15 per cent; since 1967 the situation has nearly reversed with new field wildcats declining to about 25 per cent and new pool wildcats increasing to over 60 per cent of exploration wells drilled in 1971.
3. The number of oil-intent exploratory wells drilled annually has declined from some 500 over the 1965 to 1968 period to about 250 in 1971; the number of gas-intent exploratory wells drilled annually has increased from the 1962-1967 level of 300-400 to 700-800 in 1970-1971.
4. Total exploratory drilling by over 200 "minor" operators has increased from 300-400 wells per year in the 1962 to 1963 period to some 900 wells per year in 1970 and 1971. Activity by ten "major" operators has varied over the decade from about 100 to 250 wells per year. It declined from 250 in the 1965 to 1968 period to under 100 in 1971.
5. Survey crew activity increased significantly over the 1965 to 1967 period but has decreased substantially in the past three years - from over 600 crew months in 1969 to about 300 crew months in 1971.
6. Total annual expenditures for geological and geophysical exploration and exploratory drilling increased from some \$80 million in the 1962 to 1963 period to a level of about \$175 million in the 1967 to 1969 period but have declined to some \$140 million in 1971.
7. Annual expenditures for rights to Crown lands increased from some \$40 million in 1962 to over \$100 million in the period 1965 to 1969 but dropped back to approximately \$35 million in 1971.

Results

1. The total number of successful oil exploratory wells drilled annually increased from about 40 in 1962 to over 150 in 1967 and 1968, and then dropped sharply to about 70 in each of the past two years.
2. The overall success ratio of exploratory wells has shown little trend over the decade within the range of $1/4$ to $1/3$.
3. The oil discovery success ratio based on total exploratory wells improved from about $1/10$ to $1/5$ over the period 1962 to 1967 but has since declined to a 1971 level of $1/12$; the success ratio based on oil intent exploratory wells has shown little trend over the decade within the range of $1/4$ to $1/3$.
4. New oil reserves discovered, as estimated at the end of the discovery year increased from about 20 million barrels per year in 1962 to nearly 400 million barrels per year in 1967 and 1968; since 1968 they have declined to the 1970-71 level of about 100 million barrels. When based on December 31, 1970, estimates, however, new oil reserves discovered increased from some 200 million barrels per year in 1962 and 1963 to over 600 million barrels in 1965 but have decreased since 1965 to recent levels of the order of 100 million barrels per year. Appreciation of recently discovered reserves will have a positive effect upon the 1965 to 1971 trend.
5. Whether expressed in terms of total or of oil-intent exploratory wells the new oil reserves discovered per well, as estimated December 31, 1970, showed a significant increase over the 1962 to 1965 period but have declined substantially since 1965; appreciation of recently discovered reserves will have a positive effect upon the 1965 to 1971 trend.

The Board accepts as reasonable the basic premise of IPAC that exploration costs, both in terms of labour and materials, have increased somewhat since its previous review of the subject in 1964. The Board has reviewed this factor, although the data are not displayed herein,

and concludes that increases in the order of one-third of the exploration costs in 1964, have occurred.

With respect to the argument introduced by Imperial that incentives to encourage exploration would merely accelerate the rate of discovery of new reserves but would have no net effect on the ultimate oil reserves eventually discovered or on the immediate production rate, the Board believes this statement to be largely but not wholly true. It appears likely to the Board that additional encouragement to investigate thoroughly all potentially productive horizons, even though they may be of the marginal commercial variety, may result in the eventual recovery of some hydrocarbon resources which might otherwise be abandoned and never re-investigated. The Board recognizes however, that such "saved" reserves are likely to be insignificant in relation to the total Provincial reserve. Furthermore, the Board agrees with Mobil, Imperial and others that the immediate market for light and medium crude oil would not be altered by completion of such potentially productive horizons.

The Board accepts the Imperial argument that, under the current optimistic outlook for increased markets for Alberta crude oil, additional incentives to explore should develop automatically in time. This view was endorsed by others, and their general opinion appeared to be that in a period of about 3 to 5 years restrictions due to proration to market demand would no longer exist. Notwithstanding that an incentive may develop naturally with time, this is not a reason to discard the possible benefits of incentives adopted in the interim.

While the Board accepts the contention of Mobil, that exploration incentives would result in drilling and production of some wells not necessary at the present time to produce the Alberta allowable and thereby result in a higher average cost of Alberta oil, the Board believes that this effect would be insignificant.

It appears clear to the Board that, having regard for the fact that recently the level of discoveries of new reserves has been declining and the gain in reserves due to discoveries, re-evaluation and enhanced recovery operations in 1970 and 1971 was less than the production, there is a need for increased exploration. Furthermore, to the extent that the long term historical trend may be taken as an indicator, the current

(1970, 1971) level of oil-intent exploratory activity is lower than is desirable.

The Board believes that the main underlying reason why the level of oil-intent exploratory activity is below what would be desirable is the disappointing results of oil-intent exploration and the lack of a new oil play. Closely related, and to a degree caused by the unsuccessful oil exploration, are the diversion of exploration funds to gas-intent exploration in the Province and the diversion of exploration funds from Alberta to other parts of Canada and the world.

Contrary to the views expressed by some interveners, the Board sees no real evidence that oil-intent exploration activity has been significantly affected by the levels of allowables provided through the proration plan. In fact during the period of decline, oil allowables have been increasing rapidly, thus providing greater incentives, particularly for the discovery of high reserve per acre pools. The significant decline in oil-intent exploratory activity started in 1970, several years after the effect of the 1964 changes in the proration plan would have been taken into account in industry planning. On the other hand the decline has occurred coincidentally with the factors enunciated above and believed by the Board to be the main causes of the decline.

The Board agrees with IPAC and most of the interveners that some further or new incentive is desirable to stimulate oil-intent exploration. To be effective in the interests of the Province the incentive must be one which will counter or offset the first and the third mentioned factors of the low level of oil-intent exploration. The Board is not optimistic that any practical or feasible incentive will go far towards offsetting the currently disappointing results of oil-intent exploration. On the other hand, to the extent that oil-intent exploration might be additionally stimulated, the prospects of making good discoveries would be enhanced; if these were made they would provide the incentive really needed.

V NEED FOR INCENTIVES FOR DEVELOPMENT OF LOW RESERVE PER ACRE POOLS

(1) Views of IPAC

IPAC claimed that under the current proration system the minimum allowance was inadequate and failed to provide sufficient cash flow, or the prospect of a reasonable payout period to enable external financing, to allow the development of low reserve per acre pools. It was claimed that to prevent such discoveries languishing as one-well pools the proration plan should be modified to incorporate a suitable incentive, and that the development of these pools would confer significant benefits on the industry and on the Province, including required additions to productive capacity.

It was claimed that exploration in Alberta frequently resulted in the discovery of low reserve pools, and that the development of such discoveries was prohibited by the low level of minimum allowance. IPAC stated that this situation had been exacerbated during the recent past by rising costs of labour, material and drilling. It estimated that, between the full implementation of the proration plan and December 31, 1970, of 115 new pool successes, 33 were producing on the minimum allowance, and some 50 per cent of these could produce at the higher level of the proposed discovery allowable. These pools had not been developed due to the low level of minimum allowables. In addition, IPAC claimed that due to the relatively high incidence of low reserve discoveries even basic exploration had been ruled out by the likelihood of low allowables. It was IPAC's contention that the implementation of additional incentives for the development of low reserve pools would provide both finance and incentive to drill wells which might prove up significant reserves and provide additional productive capacity. IPAC submitted that, in order to be effective, incentives would have to be applied to both discovery and development wells.

(2) Views of the Interveners

Dome, Home, Union Oil and Western Decalta supported the IPAC submission and the claim that an incentive for development of low reserve pools was necessary.

ARCO implied support for IPAC, and proposed that, as productivity would be of greater importance in the future, an incentive for development should be adopted, which should apply only to pools discovered after the institution of the incentive.

The CAODC supported the IPAC proposal, claiming that the current proration plan had discouraged development and that an additional incentive was required to develop potential reserves, and prevent further deterioration of proven reserves.

The other interveners expressed reservations or outright opposition concerning the application of incentives to development wells. Amoco claimed that there was no merit in the development of low reserve pools, and that the additional productive capacity was not required at the present time. Aquitaine claimed that an incentive for development was not required and would lead to excessive development drilling, undermine the objectives of the existing proration plan, and that the result would be a return to fully drilled spacing units. The CPA reported that although the majority of its members supported the IPAC proposal, some respondents had expressed the reservation that the allowable concept as proposed could result in over development of a pool by closely spaced wells. Chevron supported incentives for exploration but not necessarily for development, claiming the latter was not required at this time. Gulf denied the need for an incentive to develop low reserve pools, claiming it was unnecessary and would destroy the proration plan objective of eliminating unnecessary drilling. Imperial denied the need for any special development incentive, claiming that sufficient incentive existed within the current system and in the growth of market demand, and that the additional high cost capacity was not required. Mobil saw no need for the encouragement of development beyond the incentives contained in the current proration plan. Shell did not make an independent submission, but supported the CPA document.

Development Statistics

As with the section dealing with exploration, the Board has found it necessary to prepare additional data relating to development drilling, particularly with reference to low reserve per acre pools, which has occurred in Alberta over the period 1962-71 in order to gain a comprehensive appreciation of the relevant trends. Much of the data have already been presented in Section IV, in conjunction with the exploration data; however, there is a significant volume of additional data.

Much of the discussion which occurred at the hearing related to "low reserves", "low reserves per acre", "marginal", "economically unattractive", "undeveloped" or "one-well" pools. IPAC and the interveners generally seemed to agree that a reasonable definition of a low reserves pool was one having initial recoverable reserves of less than about 200,000 barrels per 160 acre DSU (approximately 1,250 barrels per acre).

The Board has reviewed the distribution of Alberta light and medium "proratable" ($U - \frac{1}{2}P$) reserves in barrels per productive acre. It finds that just over 2% of the proratable reserves of the Province are in pools with less than 1,250 barrels per acre and about 5% are in pools having less than 2,000 barrels per acre. The distribution curve is presented as Figure V-6.

Pursuant to the discussion published by the Board in OGCB Report 64-10 and quoted in Section II hereof, the Board now considers that pools having proratable reserves of 2,000 barrels per acre, or 320,000 barrels per 160 acre DSU, are near the upper limit of "low reserves per acre" pools. Anticipated 1972 minimum month and average month allowables for this DSU would be about 32 and 38 barrels per day respectively. A possible definition of the lower level of pools in which a suitable return on further investment might be anticipated might be those having proratable reserves of the order of 1,000 barrels per acre. At this reserve level the expected minimum and average prorated allowables for a 160 acre DSU would be 16 and 19 barrels per day respectively.

The Board does not consider the fact that a particular pool has only one well in it to be a useful indication of the economic prospects for future development. In many such pools further drilling may have been discouraged by geological, seismic or other factors not at all related to the allowable system.

The Board will, in this area of concern, focus its attention primarily on those pools having proratable reserves of the order of 1,000 barrels per acre or less, and where indicated by the situation, will include pools having up to about 2,000 barrels per acre.

Overall Drilling Activity

Figure IV-1 presents a plot of the number of development wells drilled over the decade. During the years 1962-70 the long-term trend shows a slight downward inclination, falling from a plateau of some 1,200 wells per year in 1962-65 to a second plateau of some 800 wells per year in 1966-70. In 1971 there appears to have been a reversal of this trend, with an increase to almost 1,000 wells.

In Figure IV-2 the decline in average well depth is shown, with development wells decreasing by some 38 per cent from 5,900 feet to 3,600 feet. As described in Section IV the major factors behind this decline are believed to be the transition of interest to shallower formations in the eastern portion of the Province and the introduction of PSU regulations, with a reduction in necessary development wells.

Figure IV-3 illustrates the trends in footage drilled, with a significant decline in the development category over the decade. This decline is a result of the decline in both the number of development wells and the average well depth.

As described previously, exploration and development wells were divided into oil-intent and gas-intent categories, according to the proportion of successful wells completed as oil and gas wells. Figure IV-4 presents the plot of development oil-intent wells drilled, which shows a declining trend over the decade, from almost 1,000 wells in the 1962-65 period, to some 300 wells in 1970

and 1971. As a percentage of total oil-intent drilling, development wells have declined from 85 per cent in 1962 to 46 per cent in 1969 recovering to 59 per cent in 1971. Factors influencing the decline in development activities after 1965 include the introduction of PSU regulations and the change to a reserve based proration plan, the Keg River play in the Rainbow-Zama area where the discoveries are generally of limited areal extent requiring few development wells, the absence of a new oil play subsequent to Rainbow-Zama, and increased interest in gas production. Since 1965 oil-intent development wells have declined fairly continuously, while gas-intent development wells have increased from 150 to over 600 wells per year.

Reserves and Production

Figure V-1 shows, for all types of crude oil, Alberta reserves additions and production over the last decade. Curve A shows net reserves additions as estimated at the end of the discovery year. The high peak value of 1964, which corresponds with the announcement of the current proration plan, is partially attributable to a revised philosophy of recognition of enhanced recovery reserves early in the life of enhanced recovery schemes, resulting in the addition of substantial reserves actually established in earlier years. The curve, over the rest of the decade shows a long term decline, with significant annual variations from the trend, from 800 million barrels in 1966 to an estimated 50 million barrels in 1971.

Curve B shows the movements in reserves additions estimated at December 31, 1970, with an estimate for the 1971 value. (These curves have been previously discussed in Section IV in greater detail.)

Curve C presents the annual crude oil production, which shows a steadily rising, and slightly accelerating trend, increasing from 165 million barrels in 1962, to over 370 million barrels in 1971. The production curve rises above the reserves additions curves in recent years, indicating a decline in remaining Provincial reserves.

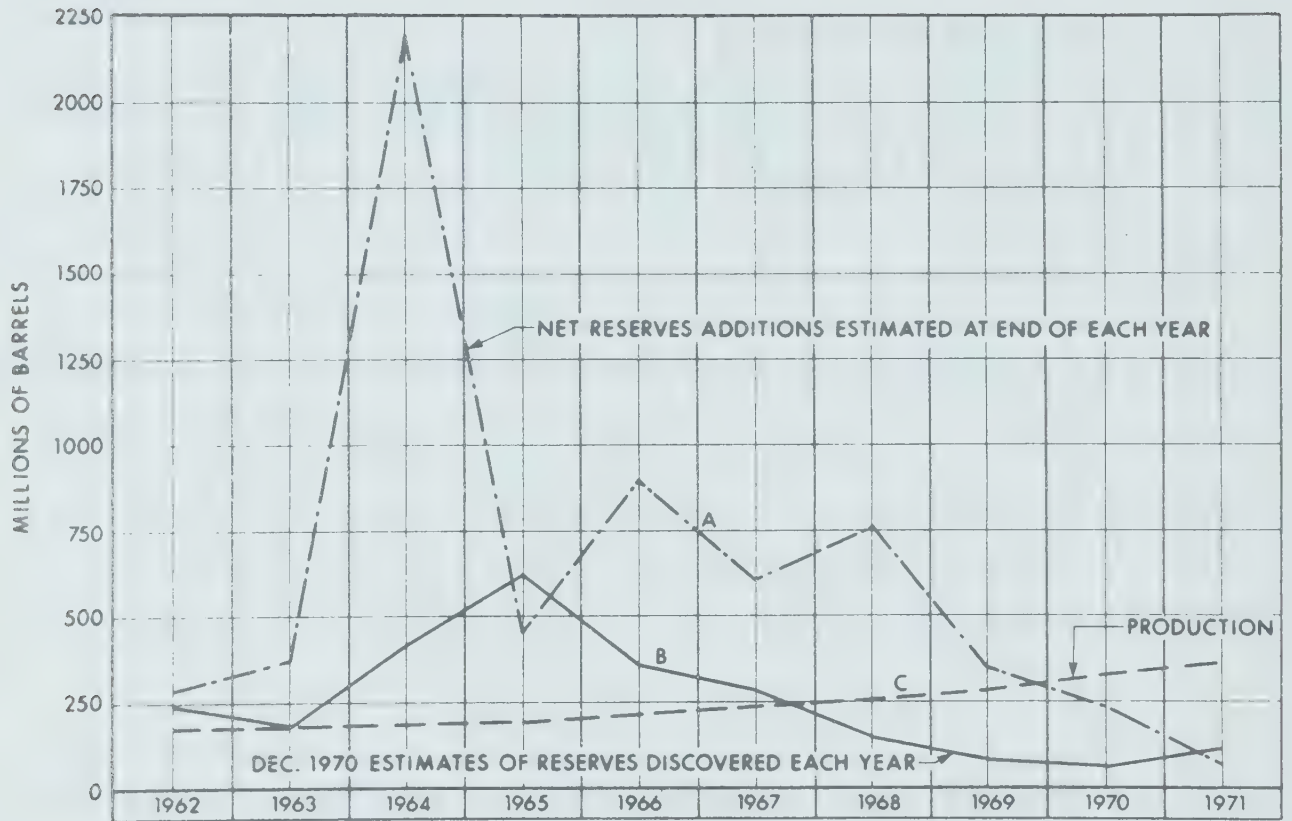


FIGURE V - 1 - RESERVES ADDITIONS AND PRODUCTION

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Reserves Changes

Figure V-2 presents a breakdown of total reserve changes by category (new discoveries, enhanced recovery, pool extensions, and pool re-evaluations).

New discoveries have increased from less than 20 million barrels in 1962 to a peak value of 390 million barrels in 1968, declining thereafter to a low of 50 million barrels in 1970, and an estimated 100 million barrels in 1971. The net additions due to enhanced recovery exhibit an abnormal peak in 1964, which was discussed in connection with Figure V-1, but otherwise shows a continual rising trend from close to zero in 1965 to a peak of some 360 million barrels in 1969, declining thereafter to close to zero (estimated) in 1971. The data reflect an accumulation, in any particular year, of newly instituted enhanced recovery schemes, plus re-evaluations of older scheme estimates. The peak value in 1969 included recognition of the Nipisi Gilwood A waterflood scheme and some additions to the Mitsue, Pembina, Provost, Rainbow and Willesden Green enhanced recovery schemes. The very low value for 1971 includes a number of positive adjustments, combined with large negative adjustments to the Pembina Cardium Pool schemes.

Additions due to pool extensions have followed a relatively level long term trend at an average value of some 85 million barrels per year. The 1971 value is not available, but is expected to be somewhat lower than this average.

Pool re-evaluations, in the years following the major changes of accounting in 1964, have exhibited a declining long term trend, from some 110 million barrels in 1965 to negative values of -280 and -160 in 1969 and 1970. The 1971 value is unavailable, but will probably be zero or somewhat negative. The large negative values in recent pool re-evaluations are due primarily to additional knowledge regarding Rainbow-Zama Keg River pools (as discussed previously in Section IV).

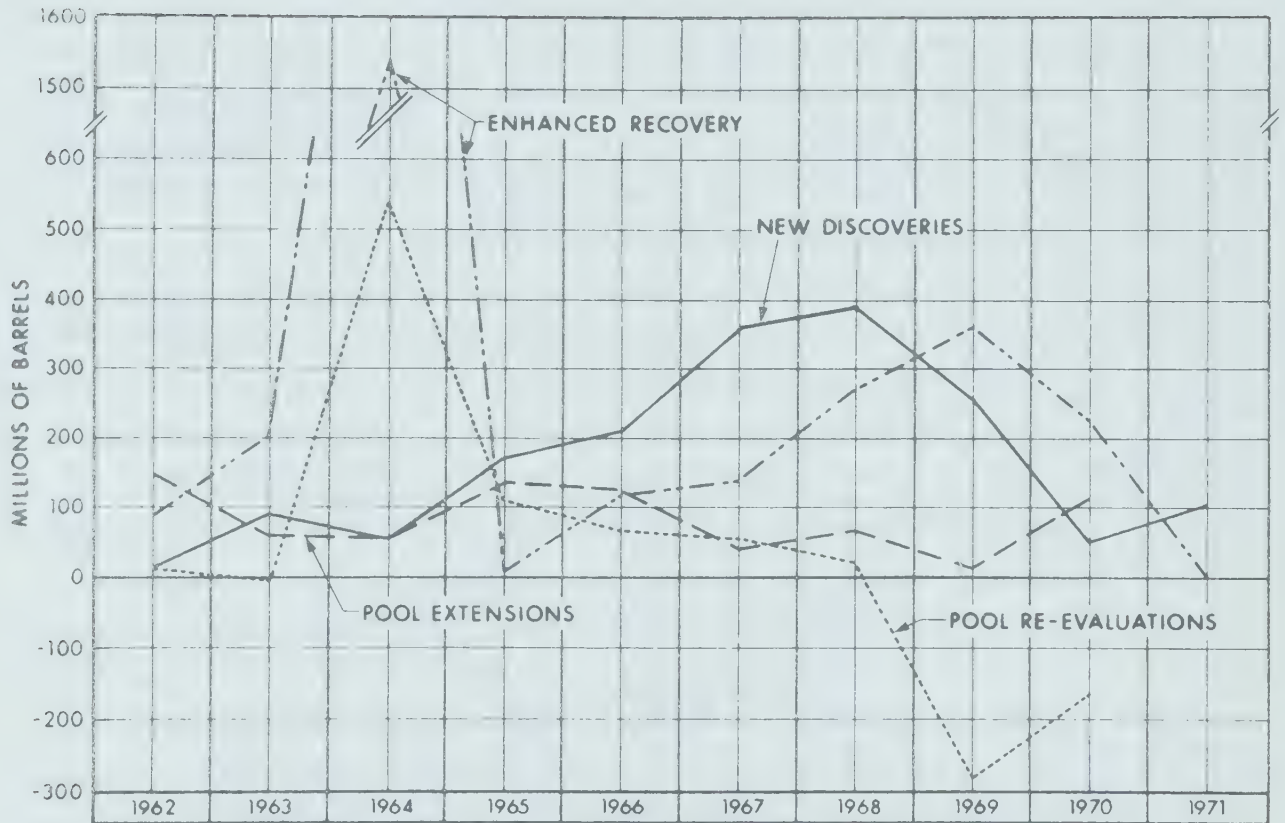


FIGURE V - 2 - RESERVE CHANGES DUE TO DISCOVERIES, ENHANCED RECOVERY, EXTENSIONS AND RE-EVALUATIONS

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Development Expenditures

Capital expenditures for development, defined to include those associated with development drilling, enhanced recovery, and field equipment purchase, are shown in Figure V-3 for the years 1962-71. These expenditures, which provide a broad measure of overall development activity, were obtained from the CPA for 1962-70, and estimated by the Board staff for 1971.

Total annual expenditures for development exhibit a general upward trend over the 1962-69 period, rising from almost \$120 million to some \$180 million. There was a modest recession in 1966, and a similar decline in 1970-71. The primary influence on this trend was capital expenditures for field equipment which increased from \$34 million in 1962 to some \$96 million in 1969, with a modest decline in 1970. Expenditures for development drilling, after three years of minor growth, declined from a 1965 peak of some \$100 million to some \$60 million in 1970 and 1971 (the reasons for the decline in development drilling have been discussed previously). Enhanced recovery expenditures have remained virtually constant over the decade at around \$10 million per year.

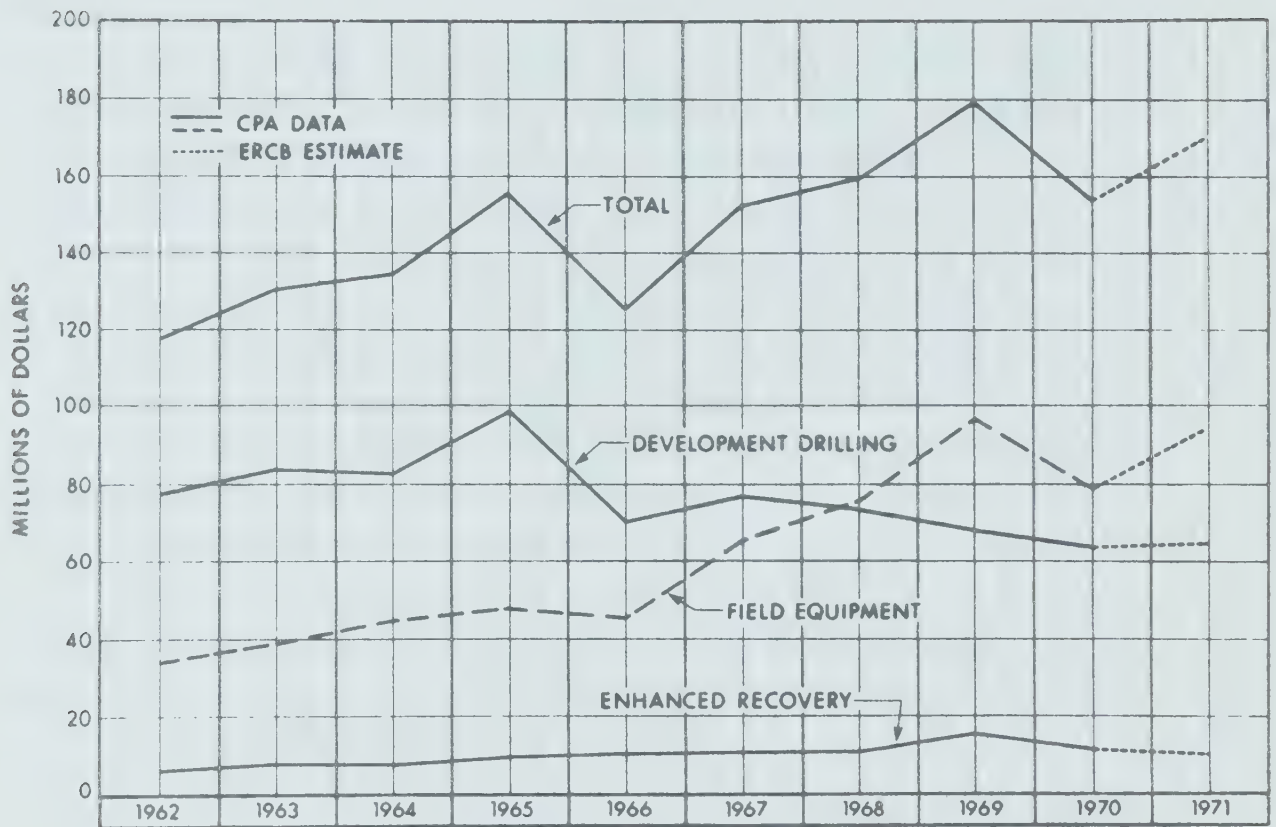


FIGURE V - 3 - DEVELOPMENT EXPENDITURES

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Follow-Up Drilling

The Board has assembled statistics on follow-up drilling in order to assess the need for a development incentive. These data cover the trend in the percentage of discoveries during the 1961-70 period which have had successful follow-up wells within a year of discovery, the adequacy of follow-up drilling, to discovery wells placed on production in 1969 and 1970, and the trend in the percentage of pools with more than one oil well when declared.

Figure V-4 presents data, for the period 1961-70, relating to the results of follow-up drilling of oil discoveries for the Province exclusive of the Rainbow-Zama area. The pinnacle reef area has been excluded from this plot as normally there is essentially no need for follow-up drilling in this development region. Discoveries have been assigned to the years in which drilling was completed on the discovery well. The curve presents, in percentage terms, the proportion of discoveries with successful follow-up drilling within twelve months following discovery.

The long term trend is definitely towards a lower percentage of oil discoveries with one or more successful follow-up wells within twelve months of discovery, declining from 44 per cent in 1961 to 5 per cent in 1970. Taken in conjunction with earlier data describing the decline in total development drilling activity, Figure V-4 indicates that, excepting the Rainbow-Zama play, the average size, or attractiveness of crude oil discoveries has been declining over the past decade.

Factors influencing the decline in the percentage of oil discoveries with successful follow-up drilling are the nature of the discoveries, the type of plays dominant during the period, and possibly the allowable in prospect for successful follow-up wells. Tables V-1, V-2, and V-3 present in numerical form, data on follow-up drilling for the entire Province, the Rainbow-Zama pinnacle reef area, and the Province excluding Rainbow-Zama.



FIGURE V - 4 - DISCOVERIES WITH SUCCESSFUL FOLLOW-UP DRILLING
WITHIN 12 MONTHS

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OIL DISCOVERY EXTENSIONS - PROVINCE-WIDE DATA*

YEAR	NO. OF OIL DISCOVERIES	NO. OF DISCOVERIES EXTENDED BY SUCCESSFUL WELLS WITHIN TWELVE MONTHS	PER CENT OF DISCOVERIES WITH SUCCESSFUL FOLLOW-UP DRILLING
1961	41	18	44
1962	46	19	41
1963	53	15	28
1964	42	12	29
1965	70	20	29
1966	61	21	34
1967	158	21	13
1968	152	9	6
1969	113	6	5
1970	42	1	2

TABLE V-2

OIL DISCOVERY EXTENSIONS - NORTHWEST
PINNACLE REEF AREA*

1965	7	4	57
1966	33	13	39
1967	132	18	14
1968	122	2	2
1969	82	-	0
1970	20	-	0

TABLE V-3

OIL DISCOVERY EXTENSIONS - EXCLUDING
NORTHWEST PINNACLE REEF AREA

1961	41	18	44
1962	46	19	41
1963	53	15	28
1964	42	12	29
1965	63	16	25
1966	28	8	29
1967	26	3	12
1968	30	7	23
1969	31	6	19
1970	22	1	5

* DISCOVERY YEAR DETERMINED BY FINISHED DRILLING DATE.

Tables V-4 and V-5 present data, in order of initial pool reserve allocation, which were assembled to examine in detail the discovery wells placed on production in 1969 and 1970, excluding Rainbow-Zama, and to determine the adequacy of follow-up drilling to these discoveries. In determining the adequacy of follow-up drilling, the geological circumstances of each discovery in addition to the discovery well's production capability, were taken into consideration. The capability has been assessed after examination of production data, and pools initially considered discoveries, although later proved to be extensions, have been included. The follow-up was considered adequate if one follow-up well was drilled within two miles of the discovery where the discovery well appeared incapable, even though geological data may suggest a further potential drilling location. Two or more wells were considered an adequate follow-up if the discovery well appeared to be capable of producing at the subsisting allowable, even though geological data might suggest further potential drilling locations.

TABLE A-4 OIL POOL DISCOVERIES - 1969

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16								
																CURRENT STATUS OF DISCOVERY WELL	FOLLOW-UP	CAPABLE OF CURRENT ALLOWABLE	RELATED FOLLOW-UP DRILLING WITHIN TWO MILES OF DISCOVERY WELL				
																			WITHIN ONE YEAR	TO 1971 YEAR END	NO. OF GAS WELLS	NO. OF OIL WELLS	NO. OF DRY WELLS
NEVIS D-30	2,120	13,250	16	233	50	-	2	0	0	3	2	0	PENALIZED WOR 1.8	ADEQUATE	PROD.								
RICINUS CARDIUM F	1,110	6,938	16	122	50	2	2	2	1	5	3	2		ADEQUATE	PROD.								
KMG BANNER RAMSEY 16-32-33-21 (W4M) (BASAL QUARTZ)	870	5,438	14	96	40	-	0	0	0	0	0	0	INCAP. GOR 2,800	INADEQUATE	PROD.								
SHELL HOME KEW 5-31-20-3 (W5M) (RUNDLE)	658	4,113	28	72	144	-	0	0	0	1	0	0	INCAP. WOR 1.1	ADEQUATE	SUSP.								
RICINUS CARDIUM A	580	3,625	24	64	113	-	2	3	4	2	3	5		ADEQUATE	PROD.								
RICINUS CARDIUM B	527	3,294	24	58	102	2	2	1	0	2	1	0		ADEQUATE	PROD.								
SWALLOW D-2A	410	2,563	17	45	57	-	4	2	0	5	2	0		ADEQUATE	PROD.								
PARFLESH LOWER MANNVILLE B	362	2,263	14	40	40	-	3	0	0	4	1	0		ADEQUATE	PROD.								
RICINUS CARDIUM D	348	2,175	24	38	113	2	3	2	1	5	2	2		ADEQUATE	PROD.								
RED EARTH GRANITE WASH L 12-21-88-7 (W5M) TRNSOON ET AL REDE	283	1,769	14	31	42	1	0	1	0	1	1	0	20 BOPD WOR 1.5	ADEQUATE	SUSP.								
MITTUE GILWOOD C	266	1,663	16	29	50	-	2	0	2	2	0	2	CAPABLE	ADEQUATE	PROD.								
MARLBORO GETTING A	258	1,613	24	28	113	2	1	0	0	2	0	0		ADEQUATE	SUSP.								
SWALLOW D-2 UNDEFINED 6-23-29-24 (W4M) CIGOL GULF SWALLOW	254	1,588	17	28	62	3	3	2	0	4	2	0	20 BOPD GOR 4,500	ADEQUATE	SUSP.								
RICINUS CARDIUM E	183	1,144	23	20	102	2	0	2	0	0	2	1		ADEQUATE	PROD.								
MESA ET AL CLARK 7-28-91-2 (W5M) (KEG RIVER SAND)	167	1,044	13	18	37	2	1	0	0	1	0	0	INCAP. WOR 1.0	ADEQUATE	SUSP.								
DRUMHELLER MANNVILLE L	167	1,044	13	18	37	1	0	0	0	1	0	0	INCAP.	ADEQUATE	SUSP.								
SENEX KEG RIVER A 7-27-92-4 (W5M) GPD NOEL ET AL SENEX	164 (AV. OF 7 WELLS)	1,025	13	18	37	3	2	6	0	2	7	0	CAPABLE	ADEQUATE	SUSP.								

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	ULTIMATE RESERVE DISCOVERY MSTB	ULTIMATE RESERVES BBL/ACRE	MINIMUM (MA) ALLOWANCE BOPD	RESERVE (RBA) ALLOWABLE BOPD	IPAC DISCOVERY ALLOWABLE BOPD	PROSPECTIVE WELL LOCATIONS	RELATED FOLLOW-UP DRILLING WITHIN TWO MILES OF DISCOVERY WELL						CAPABLE OF CURRENT ALLOWABLE	FOLLOW-UP	CURRENT STATUS OF DISCOVERY WELL
							WITHIN ONE YEAR TO 1971 YEAR END								
							NO. OF DRY WELLS	NO. OF OIL WELLS	NO. OF GAS WELLS	NO. OF DRY WELLS	NO. OF OIL WELLS	NO. OF GAS WELLS	INCAP. GOR 2,400		
HUSSAR GLAUCONITIC DD	138	862	14	15	40	1	0	3	1	0	0	2	INCAP.	ADEQUATE	PROD.
AMTRDG ET AL BARTH 11-19-38-18 (W4M) (MANNVILLE)	(130)*	(4,242)	13	14	37	2	0	0	0	0	0	0	INCAP.	INADEQUATE	ABAN. (PLUGGED BACK)
PENDANT D'OREILLE MANN F 10-34-2-7 (W4M) CMG PENDOR	107	699	11	12	36	2	0	0	2	0	0	6	50 BOPD	INADEQUATE	ABAN. (PLUGGED BACK)
NIPISI GILWOOD C	99	619	16	11	50	2	2	5	0	2	11	0		ADEQUATE	PROD.
ACHESON BLAIRMORE K	92	2,300	13	10	37	(2)**	0	1	0	0	1	0	CAPABLE	INADEQUATE	PROD.
PEMBINA BELLY RIVER MM	81	506	13	9	37	-	0	9	0	0	9	0		ADEQUATE	PROD.
UTIKUMA GILWOOD A	75	469	16	8	50	1	2	0	0	2	0	0		ADEQUATE	PROD.
RICINUS CARDIUM C	65	406	22	7	93	2	0	4	1	1	4	2		ADEQUATE	PROD.
KR JARROW 10-17-45-11 (W4M) (VIKING)	(61)	(381)	10	7	36	2	0	0	0	0	0	0	INCAP. GOR 50,000	ADEQUATE	SUSP.
HUSKY INC KR ESTHER 6-23-32-1 (W4M) (BAKKEN S)	(61)	(381)	11	7	36	3	0	0	0	0	0	0	20 BOPD WOR 0.35	INADEQUATE	SUSP.
HUSSAR BASAL MANNVILLE KK	47	294	14	5	40	-	1	0	0	1	0	0		ADEQUATE	SUSP.
TEXACO MARLBORO 10-12-54-18 (W5W) (CARDIUM)	(31)	(194)	17	3	57	-	0	0	1	0	0	1		ADEQUATE	ABAN.
HUSKY INC ESTHER 7-34-32-1 (W4M) (BAKKEN S)	(28)	(175)	11	3	36	3	0	1	0	0	1	0	15 BOPD WOR 0.08	ADEQUATE	SUSP.
DRUMHELLER MANNVILLE F	13	81	GPP		37	1	0	0	0	0	0	0	GOR 40,000	ADEQUATE	PROD.

* ULTIMATE RESERVES INCLUDED WITHIN BRACKETS ARE BASED ON PRELIMINARY ESTIMATES.
** LOCATIONS WITH PRODUCING WELLS IN DEEPER ZONES.

TABLE 1.5 OIL POOL DISCOVERIES - 1970

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CURRENT STATUS OF DISCOVERY WELL															
FOLLOW-UP															
CAPABLE OF CURRENT ALLOWABLE															
RELATED FOLLOW-UP DRILLING WITHIN TWO MILES OF DISCOVERY WELL															
WITHIN ONE YEAR															
To 1971 YEAR END															
No. OF GAS WELLS															
No. OF OIL WELLS															
No. OF DRY WELLS															
No. OF GAS WELLS															
No. OF OIL WELLS															
No. OF DRY WELLS															
PROSPECTIVE WELL LOCATIONS															
IPAC DISCOVERY ALLOWABLE BOPD															
RESERVE (RBA) ALLOWABLE BOPD															
MINIMUM (MA) ALLOWANCE BOPD															
ULTIMATE RESERVES BBL/ACRE															
ULTIMATE RESERVE @ DISCOVERY MSTB															
NEVIS D-3E	7,430	46,437	17	817	57	-	2	0	0	3	0	0		ADEQUATE	PROD.
NEVIS D-3F	1,493	9,331	16	164	50	-	0	0	0	0	0	0		ADEQUATE	PROD.
RICINUS CARDIUM H	1,160	7,250	18	128	66	-	0	0	1	0	1	1		ADEQUATE	PROD.
RICINUS CARDIUM G	402	2,513	20	44	84	1	0	0	1	0	1	1		ADEQUATE	PROD.
NITCN CARDIUM A	375	2,344	14	41	40	2	3	0	0	3	0	0		ADEQUATE	PROD.
JEFF LAKE ET AL OKOTOKS 11-35-14-29 (W4M) (TURNER VALLEY)	336	2,100	21	37	84	2	0	0	0	1	0	0	INCAP.	ADEQUATE	SUSP.
PACIFIC 10E RICINUS 6-36-33-8 (W5M) (CARDIUM)	216	1,350	22	24	93	2	0	0	1	0	1	1		ADEQUATE	PROD.
MIKWAN D-2A	193	1,206	16	21	50	-	3	2	1	3	2	1		ADEQUATE	PROD.
KISSINGER COLD HANNA 7-35-31-14 (W4M) (LOWER MANNVILLE)	187	1,169	13	21	34	2	0	0	0	0	0	0	PENALTY GOR 12,000	INADEQUATE	SUSP.
PEMBINA KEYSTONE BELLY RIVER 00	187	1,169	12	21	30	3	2	0	0	3	0	0		ADEQUATE	PROD.
STANMORE UPPER MANNVILLE B	178	1,113	12	20	30	0	0	0	7	0	0	7		ADEQUATE	PROD.
ATKINSON ET AL CHICKADEE 6-15-60-14 (W5M) (BEAVERHILL LAKE)	136	850	23	15	102	4	0	0	0	0	0	0	GOR 5,000	INADEQUATE	PROD.
MANA ET AL RED EARTH 12-6-89-8 (W5M) (SLAVE POINT)	133	831	13	15	37	1	0	2	0	0	2	0		ADEQUATE	PROD.
SYLVAN LAKE JURASSIC M	116	725	19	13	75	-	0	1	0	0	1	0	WOR 0.7	ADEQUATE	PROD.
HOME PEMBINA FERRIER 11-18-38-7 (W5M) (CARDIUM)	115	719	20	13	75	4	0	0	0	1	0	0		INADEQUATE	PROD.

TABLE V-5 OIL POOL DISCOVERIES 1970 (CONT'D)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	ULTIMATE RESERVE @ DISCOVERY MSTB	ULTIMATE RESERVES BBL/ACRE	MINIMUM (MA) ALLOWANCE BOPD	RESERVE (RBA) ALLOWABLE BOPD	IPAC DISCOVERY ALLOWABLE BOPD	PROSPECTIVE WELL LOCATIONS	RELATED FOLLOW-UP DRILLING WITHIN TWO MILES OF DISCOVERY WELL						CAPABLE OF CURRENT ALLOWABLE	FOLLOW-UP	CURRENT STATUS OF DISCOVERY WELL
							WITHIN ONE YEAR			TO 1971 YEAR END					
							NO. OF DRY WELLS	NO. OF OIL WELLS	NO. OF GAS WELLS	NO. OF DRY WELLS	NO. OF OIL WELLS	NO. OF GAS WELLS			
UTIKUMA GILWOOD B	109	681	16	12	50	2	0	0	0	0	0	0	WOR 0.25	INADEQUATE	PROD.
MARBORO GETTING B	104	650	24	11	113	2	1	0	0	1	0	0	INCAP. GOR 6,000	ADEQUATE	SUSP.
MANA RED EARTH 4-1-89-8 (W5M) (SLAVE POINT)	91	569	13	10	37	(NOW INCLUDED IN SAME POOL AS MANA ET AL RED EARTH 12-6-89-8)									PROD.
COUTTS MOULTON B	56	350	11	6	30	2	3	1	0	3	1	0		ADEQUATE	SUSP.
RED EARTH GRANITE WASH M	43	269	14	5	40	2	1	0	0	1	0	0	INCAP.	ADEQUATE	PROD.
RED EARTH GRANITE WASH N	22	138	14	2	40	2	0	0	0	0	0	0	WOR 1.0	INADEQUATE	PROD.
FORESTBURG VIKING A	-	-	11	-	30	1	1	0	0	1	0	0		ADEQUATE	ABAN.

The main features of Tables V-4 and V-5 are summarized by allowable category and follow-up status in Table V-6. Out of the 31 discoveries in 1969, 84 per cent were adequately followed up, while for the 22 discoveries in 1970, the proportion fell to 77 per cent. Of the ten cases where follow-up drilling appeared inadequate, five of the discovery wells were abandoned, suspended, or incapable of producing the appropriate allowable. If the assumption is accepted that follow-up drilling is not required where the discovery well is abandoned, suspended or incapable, follow-up has been inadequate for only some 10 per cent of the oil discoveries made in the two-year period.

Table V-7 presents a summary of the number of oil pools declared over the 1961-71 period, classified by the number of wells per pool. The data show the effect of including the Rainbow-Zama area in the years 1967-69, but even discounting the effect of the pinnacle reef development, the long term trend in the percentage of pools with two or more productive wells is downward. Interpretation of this trend should give some consideration to the change in procedure by which the Board currently declares pools somewhat earlier in their life than it did in previous years. In addition, new pools discovered in old field areas are declared even though only one well exists, and old field areas cover a progressively larger area of the Province.

TABLE V-6
SUMMARY OF FOLLOW-UP DRILLING TO 1969 AND 1970 DISCOVERIES
SHOWN IN TABLES V-4 AND V-5

WELL STATUS	FOLLOW-UP CATEGORY	1969			1970			
		(1) RBA	(2) MA	(3) MA ≤ RBA ≤ DA	RBA > DA	RBA < MA	MA ≤ RBA ≤ DA	RBA > DA
ABANDONED, SUSPENDED, OR INCAPABLE (4) CAPABLE	ADEQUATE	4		8	0	3	1	0
	INADEQUATE	1		2	1	0	1	0
	ADEQUATE	6		6	2	3	6	4
	INADEQUATE	1		0	0	4	0	0

- (1) RBA - RESERVE BASED ALLOWABLE
 (2) MA - MINIMUM ALLOWANCE
 (3) DA - DISCOVERY ALLOWABLE PROPOSED BY IPAC
 (4) CAPABLE - WELLS WHICH APPEAR ABLE TO PRODUCE THE WELL'S PRESENT ALLOWABLE

TABLE V-7
STATUS OF POOLS DECLARED AT TIME OF DECLARATION
PROVINCE-WIDE DATA

1	2	3	4	5
DECLARATION YEAR	NO. OF SINGLE WELL POOLS	NO. OF MULTI-WELL POOLS	TOTAL NO. OF POOLS	PER CENT OF POOLS WITH TWO OR MORE WELLS
1961	11	17	28	61
1962	9	7	16	44
1963	30	14	44	32
1964	40	19	59	32
1965	37	20	57	35
1966	42	19	61	31
1967	128	18	146	12
1968	128	11	139	8
1969	163	16	179	9
1970	54	6	60	10
1971	37	7	44	16

Reserves Distribution

Figure V-5 shows the percentage distribution of Alberta initial recoverable crude oil reserves in prorated pools, excluding those pools which are suspended or on good production practice, in terms of barrels per "isopach" acre. The data on which the figure is based show that less than 1/5 of one per cent of the reserves are in pools having an average reserve of less than 100 barrels per acre (although this includes 100 pools), that 50 per cent of the Provincial reserves are in pools having more than 7,800 barrels per acre, and that the highest reserve per acre pool has over 260,000 barrels per acre although it contains less than 1/3 of one per cent of Alberta's reserves.

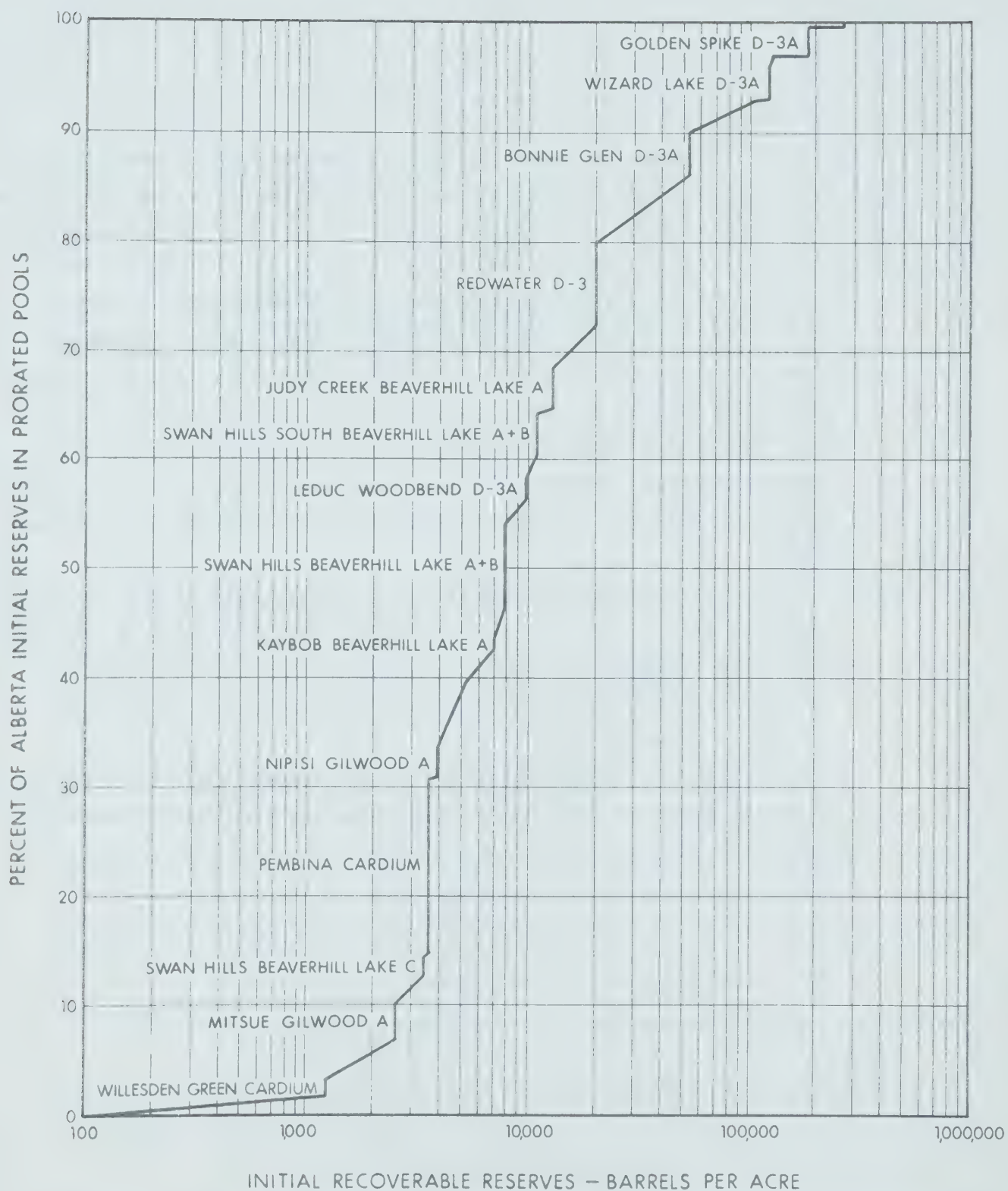


FIGURE V-5 - DISTRIBUTION OF INITIAL RESERVES OF PRORATED POOLS
IN BARRELS PER ACRE

Figure V-6 shows the distribution of initial recoverable reserves per isopach acre, and the distribution of proratable reserves per assigned acre, for prorated pools of less than 3,000 barrels per acre.

The distribution plot for initial recoverable reserves illustrates in greater detail the lower end of the line shown on Figure V-5. It shows that those pools having initial reserves less than 1,000 barrels per acre comprise some 1 per cent of the total, pools having less than 2,000 barrels per acre comprise about 5 per cent of the total, and those having less than 3,000 barrels per acre make up some 12 per cent of the total initial reserves in prorated pools.

The plot of proratable reserves per assigned acre approximates the initial reserves plot over most of the range. At the upper end the curve shows that pools having less than 3,000 barrels per acre comprise a little over 10 per cent of the total Provincial proratable reserves.

As in Figure V-5, the plots do not include heavy crude pools, suspended pools or light and medium crude pools on "good production practice".



FIGURE V-6 - DISTRIBUTION OF INITIAL AND PRORATABLE RESERVES
OF PRORATED POOLS - LOW RESERVES PER ACRE POOLS

(3) Views of the Board

The record of development activity over the 1962 to 1971 period and the results achieved may be summarized as follows:

Activity

1. Total number of development wells has remained nearly constant at about the 800 per year level since 1966, a decline in oil-intent development wells being offset by a growth in the number of gas-intent development wells.
2. The number of development wells in oil pools has declined from around 900 per year in the early 1960's to about 300 per year in 1970 and 1971.
3. Of the 53 oil discoveries made in 1969 and 1970, outside the Rainbow-Zama area, 30 had accredited reserves over 1,000 barrels per acre and 23 were between 1,000 and about 100 barrels per acre. In the first group, 10 of the discoveries have been suspended or abandoned and all but 4 of the discoveries appeared to have adequate follow-up. In the second group 9 of the discoveries have been suspended or abandoned and a total of 6 appeared not to have adequate follow-up including 1 of the 1969 discoveries, and 4 of the 1970 discoveries, which appear capable of producing at current allowable levels.
4. Total expenditures for pool development have increased fairly steadily over the 1962-1969 period, and levelled

off in 1970 and 1971. Expenditures for drilling have accounted for a decreasing proportion of total development expenditures over the decade.

Results

1. Outside the Rainbow-Zama area the percentage of oil discoveries (most of which apparently had adequate follow-up) which have had successful follow-up drilling has declined from a 30 - 40 per cent level in 1961-1966 to recent levels of below 20 per cent.
2. Using estimates made at the end of each year, net oil reserve additions from new discoveries, pool extensions, re-evaluations and enhanced recovery operations have declined from a peak of some 2,200 million barrels per year in 1964 to levels of 230 million barrels in 1970 and to 50 million barrels in 1971. Such additions failed to replace production in 1970 and 1971. Based on December 31, 1970, estimates, the corresponding decline was from a peak of 600 million barrels in 1965 to values of 50 to 100 million barrels in 1970 and 1971. The values for the more recent years would be expected to exhibit the greatest amount of future growth as a result of further evaluation and institution of enhanced recovery.

Majority View - (D. R. Craig and Vernon Millard)

The decline in oil development wells since 1965 essentially reflects the nature of the discoveries during this period. The major oil play at this time was in the Rainbow-Zama area and resulted in the discovery of a multitude of pinnacle reefs which did not require many, if any, development wells. The other discoveries were relatively few and in general appeared small. Consequently they also resulted in minimum development. In addition, the impact of the PSU regulations under the new proration plan minimized development drilling in pools such as Mitsue and Nipisi, which were discovered in 1964 and 1965 respectively.

The analysis presented in Part V, of the 1969 and 1970 discoveries, indicates that six of the 23 low-reserve discoveries (reserves less than 1,000 barrels per acre) or approximately one-quarter appear to have had inadequate follow-up. The qualitative nature of this analysis is recognized, as well as the fact that the prospective allowable is only one of several factors considered in deciding whether or not to drill a follow-up well. Nevertheless in general, the results of the analysis suggest to us that while the IPAC contention of inadequate incentive to follow up discoveries in low reserve per acre pools might have been overstated, there does appear to be evidence of inadequate development of some low reserve per acre discoveries.

It is not possible to predict what would have been the outcome had further drilling proceeded in these and other similar instances. IPAC concluded that in some cases significant reserves would have been discovered as a result of such action. We accept that this is a possibility.

While only passing reference was made at the hearing to the adequacy of the delineation of already "developed" low reserve per acre pools, it appears to us that this matter must also be considered. It is not practical to examine in detail all low reserve per acre pools but as a general proposition it appears probable that increased incentives for development in these pools (such as higher allowables) would result in further drilling, and that in some cases this would extend the pool beyond the present drainable limits and increase recoverable reserves.

Another factor that is of importance in considering the need for development incentives is the inter-relationship between exploration and development in the low reserve per acre pools. For example, the first two or three follow-up wells to a marginal or sub-marginal discovery are really drilled in the hope of finding an economically viable pool, and are essentially exploration oriented although classed as development wells. Similarly a well drilled on the periphery of a pool in the hope of extending the economic limits of pool development is exploration oriented. Thus, in many respects it is artificial, in low reserves per acre pools, to separately consider the question of need for increased incentive for exploration and for development. It is important to recognize that improved incentives for exploration could be frustrated, and in fact negated for low reserve per acre pools, if compatible development incentives were not provided.

To date, low reserve per acre pools have not made a significant contribution to the total recoverable crude oil reserves of the Province. Pools having reserves less than 1,500 barrels per acre currently account for about four per cent of the total initial reserves or three per cent of the total proratable crude oil reserves and in total do not produce their reserves-based allowable in a high demand month. With respect to the future however, the medium and lower reserve pools appear certain to become a more important fraction of the total since there is a strong indication that the prospects for major pool discoveries have declined substantially.

There is an obvious need for the Alberta industry to achieve a significant improvement in reserve growth since in both 1970 and 1971 reserve additions were less than production and the anticipated increase in production rates during the next few years are expected to bring about a rapid decline in the life index. Under these circumstances it is our view that the need for an incentive to develop low reserve per acre pools need not be proven beyond doubt. Believing that a need is at least indicated and providing that incentives can be developed which would not derogate from the broad objectives of the basic proration plan, then we believe that such incentives would be in the right direction and in the best interests of the Province.

Anticipating to some extent the Board's assessment in Section VI of the suitability of special allowable as an incentive for exploration and development of low reserve per acre pools, we have considered the possible impact of development incentives on the proration plan. We note that many of today's conditions were not present in 1964 when the Board last examined the proration plan. At that time there was extensive overdevelopment, the rate of production was about one-third of the developed wellhead capacity, the Alberta life index was 34 years and the market outlook was uncertain.

Today, remaining recoverable reserves have declined for two consecutive years and the life index at the end of 1971 was 21 years. It is highly probable that the United States-imposed market restriction on Canadian oil will be removed within two to three years and the need for prorating to market demand probably will disappear within about five years. During this transition period, well allowables will increase rapidly and the current modest trend to infill drilling will increase substantially in many pools.

In these circumstances the impact on the high reserve pools of providing increased incentives for the development of low reserve per acre pools (somewhat smaller allowable increases than would otherwise be the case) would be slight and would be short-lived. The possibility of excessive overdevelopment resulting either in a significant degree of unnecessary productive capacity or in a serious detriment to incentives for general exploration appears most unlikely. Also, there is at least an indication that the consequent modest transfer of income from high reserve to low reserve per acre pools for the short term transition period would tend to favour Alberta-based activity. We believe that there is little or no likelihood of derogation from the basic objectives of the proration plan providing that additional incentives for the development of low reserve per acre pools were consistent with sound conservation principles.

In summary, it is the majority view that under current circumstances there is a need for increased incentives for the development of low reserve per acre pools and that the modest short-term impact on other pools would be more than balanced by the potential for improvement in crude oil reserve growth.

Minority View - (G. W. Govier)

I have considered the views and data submitted by IPAC and the interveners and the further statistical information presented earlier and find little real evidence to indicate that there has been, or is, any inadequacy of development of significant new oil discoveries. I believe that the facts indicate that the overall decline in annual oil development drilling since 1965 is due to

- (a) opportunities for economies in pool development through the creation of PSU's and the consequent wider well spacing,
- (b) the nature of the pinnacle reef discoveries of the Rainbow-Zama play, requiring little development beyond the discovery well,
- (c) the fact that, apart from the Rainbow-Zama play, the quality of discoveries has been declining for the past several years (see discussion of Figure V-4).

The detailed statistics relating to the degree of follow-up drilling within a one to two year period for discoveries made in 1969 and 1970 does not in my opinion substantiate the IPAC claim that many discoveries have not been adequately developed. Granted a few extremely low reserve per acre discoveries have not been followed up but these tend to be the least attractive and represent the transition quality between those "discoveries" which properly are abandoned or suspended and those which really merit follow-up. Their numbers, reserves and productivity are of little significance in the Provincial total. All Provincial reserves in the below 1,000 barrels per acre category aggregate only about one per cent of the Provincial total. The few such reserves which might not yet have had adequate follow-up will aggregate only a fraction of one per cent of the total and even these will be reduced with the passage of time. (There has only been one full year for further development of the 1970 discoveries compared with two full years for the 1969 discoveries.)

I accept that a special development incentive (such as an increase in allowable) for low reserve per acre pools would result in an increase in development drilling of locations presently considered

sub-economic on the peripheries of many pools, both old and recently discovered. I also believe that such an incentive might have resulted in further development of, perhaps, 2 or 3 of the 5 capable-well oil discoveries of 1969 and 1970 which have not yet had adequate follow-up. It is my opinion however that any real increase in reserves or productivity resulting from either of these types of development would be insignificant in the Provincial total. In fact, as pointed out by some of the interveners, further development drilling so stimulated would tend slightly to increase the total cost of developing reserves and providing productive capacity - contrary to one of the 1964 objectives of the proration plan.

There is no question of the need for proper development of both existing oil pools and new discoveries to support growth of reserves and productivity for the Province. The point is that there is no evidence of inadequate development of older pools and, with few and understandable exceptions, such discoveries as have recently been made appear to me to have been adequately developed. Further development would be of questionable benefit to Alberta.

With my colleagues I recognize a relationship between the level of allowables for all wells - and especially for wells in low reserve per acre pools - and the attractiveness of an exploration venture. It seems self-evident that the greater the potential reward (or the higher the potential allowable) the more attractive any exploratory test becomes. However I reason that since, in my view, a special incentive is not needed for development itself, the provision of one which would foster unneeded development is not warranted even in the cause of promoting exploration. If there were no cost of providing the proposed incentive I could not oppose it but I cannot conceive of an incentive for the development of low reserve per acre pools, and especially an allowable incentive, which, one way or another, would not represent a cost to the industry and indirectly to Alberta.

I conclude that a special incentive to stimulate development of low reserve per acre oil pools is not needed.

Composite View

The majority view of the Board discussed previously supports the need for new or further incentives both for oil-intent exploration

and for development of low reserve per acre oil pools; the minority view, discussed above, is in support of the former but not of the latter. The holder of the minority view accepts that the majority view prevails as that of the Board and, with this decision in principle made, he joins with the other Board Members in the views on implementation as expressed in Sections VI, VII and VIII. The views expressed in Section IX are those of the full Board unqualified by the minority view.

VI SUITABILITY OF A SPECIAL ALLOWABLE AS AN INCENTIVE
FOR EXPLORATION AND DEVELOPMENT OF LOW RESERVE PER ACRE POOLS*

(1) Views of IPAC

IPAC contended that the implementation of a special allowable to apply to successful exploratory and development wells would increase exploration in the Province by improving the economics of low reserve crude oil pools. Mr. Dunkley, witness for IPAC, stated that every company drilling an exploratory well in Alberta is hopeful of finding a high reserve, high productivity pool. He noted that these companies recognize that the chances of finding such a success are slim but that there is a possibility of finding something up-hole in the Viking, the D-2 or the Cardium formations. He stated that discoveries in these formations had historically resulted in low but highly productive reserves. It was IPAC's contention that by providing the operator with a reasonable rate of return on these up-hole discoveries, he would be more inclined to drill to the deeper zones. IPAC stated that applying a special allowable to all wells in a pool could result in sizeable oil fields being established. It contended that the adoption of a special allowable would not interfere with any subsequent incentive package and in the event inconsistencies did arise, a change could be made.

IPAC argued that the implementation of a special allowable would result in increasing cash flows to crude oil producers which would support an increasing exploration effort in the Province. Mr. Dunkley testified that he could not guarantee that the implementation of a special allowable would result in the expenditure of more funds for exploration within the Province than might otherwise occur. He stated that he believed such a development would depend on the result of the exploration effort over the next few years.

*Evidence submitted by IPAC and interveners pertained to the suitability of a discovery allowable as an incentive for exploration and development. The Board has interpreted this evidence as being indicative of their views concerning the suitability of a special allowable as an incentive for exploration and development of low reserve per acre pools.

IPAC agreed that the implementation of a special allowable would do nothing to increase the total market for Alberta crude oil and would not increase the total Provincial cash flow realized from crude oil sales. IPAC contended, however, that the implementation of such an allowable would provide for a redistribution of the generated income in favour of those companies more inclined to reinvest in exploration and development in Alberta. IPAC stated that these would probably be the smaller companies. Mr. Dunkley did not agree with suggestions that the application of a special allowable to development wells would result in a smaller proportion of total expenditure going to exploration than might otherwise occur. As well, Mr. Dunkley did not agree that the granting of a special allowable to all wells in a qualifying pool would result in the drilling of unnecessary wells, the development of unneeded productive capacity or the discouragement of enhanced recovery in pools receiving the special allowable. Mr. Dunkley agreed that the adoption of a special allowable would not increase the reserves of crude oil ultimately discovered in the Province but contended that it would increase the finding rate.

In its testimony, IPAC referred from time to time to the need to encourage more drilling in low reserve pools in order to ensure effective drainage of those pools. However, IPAC agreed that there was not necessarily a direct relationship between drainability and crude oil reserves per acre.

The witnesses for IPAC stated that a number of other methods of stimulating exploration in Alberta had been considered. In this respect reference was made to modifying the existing land regulations and the allocation of production from incapable pools on the basis of excess productivity rather than on the basis of reserves. The details of these alternatives were not discussed. With respect to alternatives suggested by interveners, IPAC stated that it was not opposed to lower taxes or royalties but believed that such prospects were unrealistic. In addition, IPAC dismissed the natural economic incentives resulting from the expanding market demand and the anticipation of the end of the need for proration as being long-term developments and irrelevant with regard to the current problem.

(2) Views of the Interveners

Many of the interveners supported the view that exploration incentives should be considered on a total or package basis. Amoco and Aquitaine contended that the Board should defer a decision on the IPAC application until a total incentive package had been developed. In this respect, Aquitaine recommended that a Government-Industry task force be set up to consider the needs for and the potential costs and benefits of, a broad range of additional incentives. Gulf and Imperial supported the need for further study of the matter of incentives. Imperial stated that the IPAC proposal should not be implemented in isolation. A minority of the CPA membership supported this view as well.

While some interveners contended that exploration incentives should be implemented on a package basis, there was general agreement among all interveners that the implementation of a special allowable would provide some incentive for exploration. Much of the support for the special allowable concept was based on the fact that its implementation would generate higher cash flows from qualifying wells and thus provide funds from which additional exploration could be financed. Despite the recognition of this relationship, various interveners expressed concern regarding the suitability of such an allowable as an incentive for development.

Amoco contended that the implementation of such an allowable would encourage over-drilling and possibly result in the diversion of funds which might have otherwise been used for exploration. It was Amoco's contention that the development of additional productive capacity in low reserve pools when it is not required has relatively little merit. In addition, Amoco stated that a special allowable of this type could diminish and possibly eliminate the incentive for implementing enhanced recovery programs which currently exists under the proration plan. Mr. Smith, witness for Amoco, did recognize that the Board had the authority to require the installation of enhanced recovery, regardless of the type of incentives offered by the allowable system. Amoco

submitted that the implementation of a special allowable should not adversely affect the objectives of the current proration plan.

Mr. Smith testified that the assignment of a special allowable to development wells was not consistent with the present proration system.

Amoco agreed that the implementation of a special allowable would be of some general economic assistance. Amoco indicated, however, that the adoption of such an allowable would provide less revenue to the Government and people of the Province as it would transfer production from fields paying at or near top royalty rates to fields which would likely be paying at lesser rates.

Aquitaine supported Amoco's contention that the assigning of a special allowable to all development wells would encourage excessive development of known reserves and discourage some secondary recovery schemes. Mr. Pantella, witness for Aquitaine, stated that development should occur without benefit of a special allowable. He agreed with the contention that granting such an allowable to some but not all wells in a pool could cause equity problems. Mr. Pantella stated that an incentive package should include some form of special allowable in order that the package served all the various sizes of companies involved in the industry.

Imperial opposed the adoption of special allowables as an incentive for exploration and development on the grounds that it represented a return to a system dedicated to wells and minimum allowances. Imperial contended that the application of a special allowable to all wells would result in an unreasonable allocation of demand among pools and would result in a gross distortion of the proration plan. Mr. Peterson, witness for Imperial, stated that a special allowable program would not have broad application with respect to a wide range of markets in terms of supply and demand.

Imperial contended that the application of a special allowable to development wells would reduce the incentive to maximize recovery by deferring the implementation of enhanced recovery. Mr. Peterson testified that the implementation of a special allowable for development wells would not increase Alberta's crude oil production rate but would promote investment in high cost incremental capacity before it was required. He stated that such a condition would reduce the incentive to minimize costs.

Imperial recognized that the implementation of a special allowable would result in increased cash flows for some companies and that it could provide an incentive for further exploration. Mr. Peterson argued, however, that it would not necessarily follow that the companies realizing the higher revenues would reinvest the money in further exploration. He also stated that the implementation of a special allowable would not lead to an increase in the recoverable reserves ultimately discovered in the Province.

Gulf agreed that the implementation of a special allowable for exploratory and development wells could assist smaller companies to get the necessary revenue to keep their operations going and to do some exploratory drilling. However, Gulf stated that there was no justification for applying such an allowable to development wells as more of this money might go into the unnecessary development of high cost low reserve per acre pools and that this would result in a reduced exploratory effort. In addition, Gulf contended that the application of a special allowable to development as well as to exploratory wells would distort to a degree the distribution of the Provincial allowable in a reasonable manner. Gulf recognized that granting a special allowable to the discovery well or a select number of wells in a pool could create an equity problem. It recommended that the Board dismiss the special allowable as an incentive for exploration in the event such a condition did arise.

Mobil stated that the assignment of a special allowable to development wells could seriously weaken the present desirable incentives in the proration plan for the discovery of new reserves and the maximum recovery of existing reserves as well as lead to the over-drilling of new pools. Mobil submitted that the implementation of a special allowable should not be such that it adversely affects the objectives of the current proration plan.

The witness for Chevron, Mr. Zerr, indicated that special allowables were one of the less desirable methods of stimulating exploration. He stated that the implementation of a special allowable as an incentive for development would have the undesirable feature of promoting over-development. Mr. Zerr did not expect that the adoption of such an

allowable would reduce the incentive to implement enhanced recovery. Chevron stated that in the absence of other incentives, a special allowable applicable to exploratory and development wells was a reasonable alternative to the present plan.

While the above interveners had reservations respecting the suitability of a special allowable as an incentive for development, other interveners supported its application to such wells.

ARCO agreed with IPAC that a special allowable was a suitable incentive for the development of pools. ARCO supported the implementation of such an incentive in newly discovered pools on the basis that it would act as an exploratory incentive. It saw no problem of discriminatory treatment in granting such allowables to some pools and not to others. Mr. Wells, witness for ARCO, stated that it was not suitable to encourage the drilling of wells not needed to produce the allowable. He agreed that during the period such an allowable was in effect, there would be reduced incentive to implement enhanced recovery. However, he contended that the Board could encourage enhanced recovery by other means. ARCO submitted that there was merit in developing additional productive capacity within the Province at this time.

The CAODC contended that the adoption of special allowables as an incentive for the development of marginal pools would result in a significantly improved economic situation for the industry and that such allowables were in the best interests of the Province. Mr. Storey, witness for the CAODC, did not believe that the adoption of a special allowable for development wells would encourage the drilling of unnecessary infill wells. He indicated that the Board could take steps as necessary to preclude this sort of problem. Mr. Storey agreed that the decline in drilling activity to which the CAODC referred in its intervention could be partly attributable to the disappointing discovery rate and the type of pools that were being discovered and not necessarily to the proration plan. He stated that it was difficult to assess the significance which special allowables might have on exploratory effort but claimed that it would be some assistance.

Dome indicated its support for the application of a special allowable to development wells. Mr. McElroy, witness for Dome, stated that such an allowable would encourage development on 160 acre spacing but did not agree that this was necessarily over-drilling. Mr. McElroy contended that the adoption of such an allowable would not reduce the incentives to implement enhanced recovery.

Home also supported the application of a special allowable to development wells. It stated that the low minimum allowances in existence since 1969 had resulted in marginal discoveries not being developed. Mr. Morison, witness for Home, contended that the implementation of special allowables for development wells would not result in the drilling of unnecessary wells or reduced incentives for enhanced recovery. Mr. Morison stated that the discovery allowable should be approved and consideration given to other methods of encouraging exploration within the Province.

Union Oil supported the implementation of special allowables as an incentive for development. It contended that the present allowable system inhibits the development of apparent low reserve discoveries and that the granting of a special allowable to development wells would aid in determining the extent of such discoveries.

Various alternatives were proposed by the interveners to stimulate exploration in the Province. Among these were revisions to the existing land regulations, price adjustments, royalty incentives and the establishment of work bonuses on future Crown reservation bids. The alternative proposals were presented by those interveners who found the implementation of a special allowable as an incentive particularly unattractive. However, none of the alternatives presented were discussed in detail. It was the contention of some of the interveners opposing the implementation of a special allowable as an incentive for development that the expansion of demand and a rising allocation factor would provide sufficient incentive to develop low reserve per acre pools.

(3) Views of the Board

Given the majority decision that a special incentive is desirable for the stimulation of oil exploration and for the development of low reserve per acre oil pools the Board as a whole has considered the suit-

ability of the provision of such an incentive through a special allowable.

Several interveners supported the concept of a special allowable for discovery wells but opposed the extension of this policy to development wells. The Board believes that granting a special allowable only to discovery wells would create a serious equity problem and would be contrary to the intent and provisions of Section 34 (1) of The Oil and Gas Conservation Act. The Board, therefore, rejects the idea of adopting an incentive for exploration by assigning a special allowable only to the discovery well.

With respect to the matter of stimulating exploration in the Province, the Board agrees with many of the interveners that there are various alternatives by which this might be accomplished. The Board, however, does not accept the argument that consideration of a special allowable incentive should be deferred pending the development of a complete exploration incentive "package". The Board concurs with IPAC that an increase in allowable could provide a stimulus to exploration but, recognizing that allowables have been increasing significantly in recent years and are expected to do so in the future, does not expect that a special allowable incentive would significantly affect exploration except to some extent for the lower reserve per acre prospects.

With respect to the development of low reserve per acre pools, the Board agrees that a special allowable would be an effective incentive but is concerned about some of the possible undesirable consequences. Several interveners contended that an allowable incentive would result in excessive development and would reduce the incentive for enhanced recovery operations. In addition the Board recognizes that a loss in recovery could occur if special allowables permitted wells or pools to be operated at rates above those appropriate for the well or reservoir conditions. Whether or not these potential results actually would occur depends on the nature of any special allowable plan adopted. The Board is satisfied that it is possible to institute a plan which would avoid most of these difficulties.

The Board concludes that, given the need for new or further incentives both for exploration and for development of low reserve per acre pools, the device of providing the incentive through a special allowable is suitable provided that safeguards could be incorporated to

prevent excessive development, to maintain incentives for enhanced recovery operations and to prevent loss of recovery through well or pool production at excessive rates. The Board recognizes that such an incentive would only be effective over the next five or so years while prorating continues.

VII SUITABILITY OF THE SPECIFIC IPAC PROPOSAL AS AN INCENTIVE FOR
EXPLORATION AND DEVELOPMENT OF LOW RESERVE PER ACRE POOLS

(1) Views of IPAC

IPAC submitted that exploration and development effort in Alberta would be encouraged by incorporating into the proration plan a discovery allowable for all wells drilled in light and medium crude oil pools first placed on production after May 1, 1969. It suggested that the discovery allowable would commence on the date of the Board's approval and would extend until five years after the "on production" date of the first well in the pool. Each well would be entitled to the greater of the discovery allowable or the prorated, reserves based, allowable for its drilling spacing unit (DSU). The discovery allowable would vary with the average depth of the wells in the pool and would range from 30 barrels per day for wells up to 3500 feet deep, to 190 barrels per day for wells over 11,501 feet deep. (Figure VII-1 and Table VII-1) The discovery allowables would be subject to normal gas and water penalties and would be assigned to each capable well in the pool, including production spacing unit (PSU) and project surplus wells, but not to suspended or service wells. The applicant proposed that the general administration of the discovery allowable would be similar to that applied to the minimum allowance under the Board's proration plan, but that the discovery allowable for wells in a PSU would be assigned in addition to a reserves-based allowable for each undrilled tract, would be transferable from well to well within a PSU, block or project and would be eligible for redistribution within a pool in the same manner as reserves-based allowables are under the existing plan, if some producing wells were incapable of producing their allowable.

The applicant agreed that maximum rate limitations (MRL's), determined having regard for ultimate conservation or prevention of well bore damage, would be an overriding limitation on the discovery allowable. IPAC suggested that, in the case of a multi-zone completion, the discovery allowable for each zone should be based on the depth of the deepest horizon.

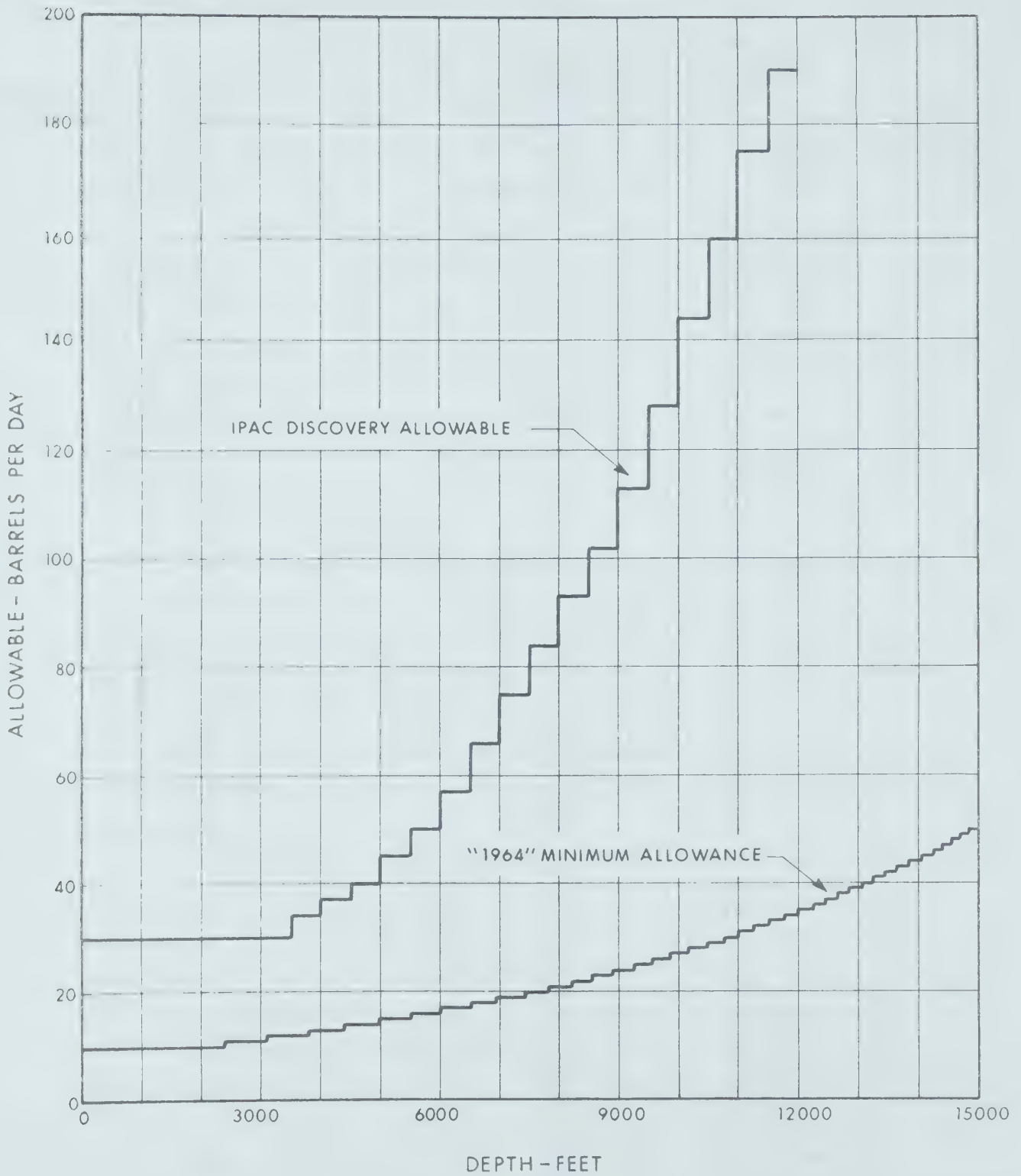


FIGURE VII-1 - IPAC PROPOSED DISCOVERY ALLOWABLE
AND EXISTING BOARD MINIMUM ALLOWANCE SCHEDULE

TABLE VII-1

Tabulation of Existing Board Minimum Allowance and
IPAC Proposed Discovery Allowable

<u>"1964" Minimum Allowance</u>		<u>IPAC - Discovery Allowabl</u>	
<u>Depth Interval (feet)</u>	<u>Barrels per day</u>	<u>Depth Interval (feet)</u>	<u>Barrels per day</u>
0-2,400	10		
2,401-3,100	11	0-3,500	30
3,101-3,800	12	3,501-4,000	34
3,801-4,400	13	4,001-4,500	37
4,401-5,000	14	4,501-5,000	40
5,001-5,500	15	5,001-5,500	45
5,501-6,000	16	5,501-6,000	50
6,001-6,500	17	6,001-6,500	57
6,501-6,950	18	6,501-7,000	66
6,951-7,400	19	7,001-7,500	75
7,401-7,800	20	7,501-8,000	84
7,801-8,200	21	8,001-8,500	93
8,201-8,550	22		
8,551-8,900	23	8,501-9,000	102
8,901-9,250	24		
9,251-9,550	25	9,001-9,500	113
9,551-9,850	26		
9,851-10,150	27	9,501-10,000	128
10,151-10,450	28	10,001-10,500	144
10,451-10,750	29		
10,751-11,000	30	10,501-11,000	159
11,001-11,250	31		
11,251-11,500	32	11,001-11,500	175
11,501-11,750	33		
11,751-12,000	34	11,501-12,000	190
12,001-12,250	35		
12,251-12,450	36		
12,451-12,650	37		
12,651-12,850	38		
12,851-13,050	39		
13,051-13,250	40		
13,251-13,450	41		
13,451-13,650	42		
13,651-13,850	43		
13,851-14,050	44		
14,051-14,250	45		
14,251-14,400	46		
14,401-14,550	47		
14,551-14,700	48		
14,701-14,850	49		
14,851-15,000	50		

The applicant suggested that geological consideration would normally be sufficient to indicate whether a particular well had discovered a new pool, but believed that, in the event of a questionable situation, a new well which was located about $2\frac{1}{2}$ miles or more from a previous producing well might be considered as a discovery. In the event that a well which had been granted a discovery allowable was subsequently proved to be a part of an older pool, the well's allowable would then be based on the allowable of the older pool.

The IPAC schedule of discovery allowables was designed to provide a 2.5 year payout before taxes, considered to be attractive enough to encourage development of low reserve per acre pools and additional exploratory drilling. (Table VII-2) The financial calculations leading to the discovery allowable schedule were based on a crude oil wellhead price of \$2.71 per barrel. IPAC claimed that the additional cash flows from the discovery allowable were not designed to pay out dry hole costs, but would provide the financing for development and exploratory drilling.

The proposed discovery allowable was to be operative for 5 years from the on-production date of the discovery well to allow orderly development of the pool, the making of reservoir studies, the obtaining of a significant quantity of production history, and to allow time to realize a profit on the original investment. IPAC emphasized that, on the average, a well receiving a discovery allowable would hold it for a period of less than 5 years, due to the delay in drilling follow-up wells.

The proposal to make pools discovered as early as May 1, 1969, eligible for the discovery allowable was intended to eliminate the need for a transition period and is related to the date upon which the minimum allowance became low enough that, in IPAC's opinion, "the drilling of many follow-up wells became financially unattractive."

IPAC opposed suggestions by some interveners that the discovery allowable should be granted only to wells which were located two miles or more (or some other fixed distance) from wells previously on production. IPAC claimed that such a restriction would not be practical in all geological situations, could result in inefficient and wasteful

TABLE VII-2*
DISCOVERY ALLOWABLES,
WELL COSTS, PRODUCTION AND PAYOUT

DEPTH	GROSS BBLs. PER DAY	ROYALTY %	NET BBLs. AFTER ROYALTY	INCOME AFTER ROYALTY \$/DAY	OPERATING EXPENSE \$/DAY	NET INCOME \$/DAY	AVERAGE DRILLING COST \$	PAYOUT YEARS
4,000	36	11.67	31.79	86.18	20.00	66.18	60,000	2.48
5,000	42	12.86	36.60	99.19	20.00	79.19	72,500	2.51
6,000	53	14.34	45.40	123.03	20.00	103.03	95,000	2.53
7,000	71	15.78	59.80	162.05	20.00	142.05	130,000	2.51
8,000	88	16.59	73.40	198.91	20.00	178.91	162,500	2.49
9,000	103	16.67	85.83	232.60	20.00	212.60	195,000	2.51
10,000	135	16.67	112.52	304.93	20.00	284.93	260,000	2.50
11,000	167	16.67	139.16	377.12	20.00	357.12	325,000	2.49

- ASSUMPTIONS:
1. Payouts based on constant rate at proposed discovery allowable.
 2. Price of crude 2.71 per barrel. (Gravity 35° API - Trucking 12¢)
 3. No income taxes payable.

* This table is a reproduction of Table #2 of the IPAC submission.

practices by encouraging operators to make long "stepouts" at considerably greater risk, and could result in reservoir loss through encouraging spacing wider than that which could be efficiently drained by a well. IPAC did not accept that enhanced recovery would be discouraged by adoption of its proposal, and in fact argued that it would be encouraged. IPAC acknowledged that its proposal might tend to encourage operators to drill a well on each quarter section in a low reserve per acre pool, but claimed that such a well density would probably be necessary to properly drain the pool.

The applicant testified that a maximum of one discovery allowable should be granted per 160 acre tract even if the area was less than 160 acres. IPAC did not comment on whether, in the case where DSU's were smaller than 160 acres, granting the discovery allowable to only one well per 160 acres would be equitable. The applicant also visualized that the discovery allowable would be in addition to the 1,000 barrel "new well test allowable" granted under the current allowable system.

IPAC estimated, for the purpose of determining the impact of its proposal on the existing proration plan, that the number of successful new field and new pool wildcat wells might increase 5 fold from 120 wells per year to 600 wells per year. It estimated that about half of the new discoveries which it anticipated would be made would have productive capability in excess of the discovery allowable. IPAC estimated that the total effect of adoption of its proposal on the remaining prorated pools would be a maximum of 32,700 barrels per day, which it claimed would be a small amount in proportion to the total market demand of 1.25 to 1.75 million barrels per day.

IPAC declared that its proposed discovery allowable would not work in favour of any particular segment of the industry, although it observed that the small producer would likely take more advantage of it than the large producer. IPAC observed that granting a discovery allowable to the discovery well only would not constitute a sufficient incentive.

IPAC acknowledged that its proposal would result in greater expenditures on drilling and production of oil in Alberta but that it would not have increased the market for Alberta crude oil. It acknowledged

that this would alter the competitive position of the various companies in the Province, possibly making it worse for some.

(2) Views of the Interveners

Amoco was in favour of the discovery allowable proposed by IPAC, including the level and 5-year time period proposed, but believed that it should be granted only to wells located two miles or more from existing producing wells that were drilled after the Board's approval of such a plan. It did not believe that discovery allowables should be granted to wells closer than two miles, even if they were truly new pool discoveries. It suggested that once a well received a discovery allowable it should be entitled to retain it, regardless of future pool delineations or coalescences. Amoco did not think that the unequal allowables which might result under its modification to the IPAC proposal would cause significant inequities within a pool.

Amoco maintained that to grant a discovery allowable to all wells in a new pool could encourage overdrilling of infill areas and result in diversion of funds which might otherwise be used for exploration. Amoco further contended that the allowables assigned to follow-up wells could diminish, if not eliminate, the incentive for enhanced recovery programs.

Aquitaine proposed that only a limited number (perhaps the first five to ten) of the wells drilled in a new pool should be entitled to a discovery allowable and that this should apply only to pools drilled following the date of the Board's decision. It believed the payout period used by IPAC, and the period over which the discovery allowable would be effective under the IPAC proposal, were somewhat generous and that both might be reviewed and modified. Aquitaine acknowledged that granting a discovery allowable to some but not all wells in a pool could result in an equity problem.

ARCO indicated partial agreement with the IPAC proposal, in that it provided incentives for development. It believed, however, that the discovery allowable should be granted to all validated tracts, whether drilled or not, within a pool discovered after the date of the Board's approval. ARCO found the proposed level and time period to be acceptable. It envisioned the benefits of granting a discovery allowable

to undrilled DSU's not as a development incentive but primarily as a significant reward for exploration. In ARCO's view, the discovery allowable administration should be like that presently accorded to a reserves-based allowable. However, it did not believe that the portion of the discovery allowable which a well was incapable of producing should be redistributed within the pool.

ARCO believed that development of additional productivity in the Province would result from the IPAC proposal, as modified by ARCO, and that this productivity would be required in the future. It did not believe any significant problems of reservoir damage due to high production rates, inequity within pools or among pools, or overdrilling would result from the adoption of its proposal. ARCO commented that its discovery allowable proposal would contain no incentive for implementation of enhanced recovery, but believed the Board had other methods for overcoming this problem.

The CAODC indicated support of the IPAC proposal as an incentive for exploration and development, specifically on the basis that it believed this would result in additional drilling in the Province, with attendant economic benefits to the Province and its people. It claimed that the proposal would not result in overdrilling or inefficient production practices.

The CPA intervened in general support of the IPAC application, but with some reservations. The division of opinion among its membership is discussed in a previous section of this report. Some of the CPA members were opposed to the assigning of a discovery allowable to pools already discovered or to the granting of it to all wells in a pool.

Chevron supported the IPAC proposal except as it related to the summation of discovery allowables and reserves-based allowable in calculating the allowable of the PSU, and as it related to pools already discovered. It considered the proposed level of discovery allowables, and the 5-year period proposed, to be somewhat liberal.

Chevron submitted the proposal would not result in a significant reduction in incentives for enhanced recovery. It observed that the proposal could result in overdevelopment or drilling of unnecessary wells at this time, but did not believe the IPAC proposal should be rejected on this account.

Gulf recommended denial of the IPAC submission. It particularly objected to the granting of such an allowable to other than the first well in a pool, the granting of it to pools discovered to date, and the provisions for transfer of discovery allowable among wells within a pool. Gulf believed a discovery allowable should only be granted as part of "an overall incentives package", and in that case that it should apply only to wells discovering a new pool after January 1, 1972. The discovery allowable suggested by Gulf would not be transferable and would terminate after 3 years. Gulf acknowledged that granting a discovery allowable to only one well in a pool could introduce inequities, and submitted that if this was considered to be a serious problem the appropriate answer would be to have no discovery allowable for any well.

Home endorsed the IPAC proposal, submitting in support that the Province of Saskatchewan allowable system made low reserve pools profitable and attractive to develop. It claimed that granting the discovery allowable to pools discovered on or after May 1, 1969, would partially rectify the problem of undeveloped low reserve pools discovered since that date.

Home declared that approval of the IPAC proposal would not result in overdrilling or reduced incentives for enhanced recovery, and claimed that enhanced recovery would in fact be encouraged.

Imperial claimed the existing proration plan provided an ideal balance of incentives for exploration, development and economical production, and that the IPAC proposal would destroy or unbalance some of these incentives.

Imperial opposed the application, particularly as it applied to development wells, because it would adversely affect the attainment of some of the objectives of the Alberta proration plan. Mr. Peterson, speaking for Imperial, stated in summary, "Firstly, it would sacrifice the allocation on the reasonable basis of reserves. Secondly, it would sacrifice the encouragement of enhanced recovery schemes by deferring the incentive. Thirdly, I think it would sacrifice the encouragement of economic optimum development and minimization of costs. I think, fourthly, it does not have broad application with respect to a wide range of markets in terms of supply and demand and I would suspect it is not administratively simple."

Mobil did not agree with several aspects of the IPAC proposal. It contended that the level of allowable suggested by IPAC was too high, such that it would encourage an explorer to search for smaller, less economic pools at the expense of larger pools. In addition, Mobil stated that implementation of the IPAC proposal would encourage over-drilling and also tend to eliminate for a time the benefits associated with enhanced recovery.

Mobil proposed in an alternate plan that a discovery allowable be assigned to new pools or those extending existing pools by more than about 4 miles; that the discovery allowable be calculated by doubling the reserves-based allowable assigned to the DSU of the eligible well; that it apply for only two years; that it be subject to gas-oil ratio and water-oil ratio penalties and be transferable from well to well in accordance with the PSU regulations; and that it be available to eligible wells which commenced drilling after the date of the Board's decision. Mobil believed that its proposal, being applicable only to wells making discoveries or significant pool extensions and offering incentives in proportion to the reserves discovered, would stimulate exploration more effectively than the IPAC proposal. In Mobil's opinion, a well which was granted a discovery allowable should have that allowable withdrawn if the well turned out to be an extension of an old pool and not a discovery. In Mobil's opinion the total additional discovery allowables assigned under its proposal would be no more, and possibly would be less, than those assigned under the IPAC proposal, and in any case would not have significant impact on the proration plan.

Shell supported the CPA intervention.

Dome, Union Oil and Western Decalta recommended adoption of the IPAC proposal.

(3) Views of the Board

The Board finds the discovery allowable rates proposed by IPAC to be excessive when compared with the generally accepted views of maximum permissive rates, intended to prevent reservoir damage. Using the preliminary rate limitation (PRL) as its best available estimate of maximum permissive rates, the Board finds the allowables proposed by IPAC to be excessive at all depths for pools having proratable reserves less than about 600 barrels per acre, at all depths greater

than about 5,500 feet for pools having reserves of the order of 1,000 barrels per acre, and at all depths greater than about 8,500 feet for pools having reserves in the 2,000 barrels per acre range. The Board recognizes that IPAC agreed that the appropriate reservoir rate limitation would override its proposed discovery allowables, but in view of the large number of cases in which rates could be excessive this feature is considered a serious limitation upon the IPAC proposal.

The fact that the rates proposed by IPAC are unrelated to some form of reserves results in them having no relationship to the nature and type of pool which they are intended to assist. The degree of allowable gain obtained by a pool, when compared with the reserves-based allowable, is relatively high in some cases and relatively low in others. The effect is that the IPAC proposal does not restrict encouragement to low reserve per acre pools.

The Board believes the adoption of the IPAC proposal would have the undesirable effect of promoting full development of all 160 acre DSU's, even where this might result in more wells than necessary to adequately explore or deplete a pool. This would be counter to the objectives of the proration plan and the PSU regulations, and could result in diversion of exploration funds into unnecessary development drilling.

Adoption of the IPAC schedule of discovery allowables would either remove or greatly reduce a major incentive for enhanced recovery projects, that is the increased allowable rates, for pools having reserves up to 2,000 barrels per acre, over the life of the discovery allowable, since the rates proposed by IPAC would be much higher than an operator might expect to obtain under the proration system. For higher reserves per acre pools the allowable incentive to install enhanced recovery would only remain for the shallower pools or for those exhibiting an unusually large increase in reserves due to the recovery enhancement scheme. The Board could require the installation of enhanced recovery schemes but in practice this would be difficult to achieve in the absence of corresponding financial incentives to the operator. The Board recognizes that other incentives for installing enhanced recovery, being the increase in ultimate recovery and the ability to maintain production rates at an adequate level, would still exist but does not believe these benefits would override the objections discussed above. The Board considers this aspect of the IPAC proposal to be particularly undesirable.

The Board believes that a special allowable plan should be such as to provide a suitable transition from the present allowable system to an eventual system of maximum rate limitations designed to prevent reservoir or well damage. The IPAC proposal does not provide for this in any way.

In view of the foregoing discussion the Board rejects the specific IPAC proposal.

Many of the criticisms raised above also apply to the alternative discovery allowable plans suggested by some of the interveners. For example, ARCO's suggestion that the discovery allowable should be applied to both drilled and undrilled tracts is subject to the criticisms that the rates proposed are excessive and that incentives to install enhanced recovery would be seriously reduced or eliminated.

The suggestion made by Mobil, that a "double reserves" approach should be used, avoids some of the pitfalls such as the encouragement of overdrilling, and has the desirable feature of being related to pool reserves, but suffers from other drawbacks. The Mobil proposal would result in extremely high allowables for any newly discovered high reserves per acre pools, which is somewhat removed from the objectives discussed in previous sections of this report. However, by being restricted to new discoveries only, the Mobil method would result in the desirable encouragement of exploration. Mobil's proposal would not result in any incentive for further development of low reserve per acre pools which have already been discovered but not adequately developed. The Board considers that the administrative complexities associated with assigning different allowables depending upon the discovery date of the pool should be avoided if possible.

For these reasons the various modifications recommended for the IPAC proposal do not make the proposal acceptable to the Board.

VIII

AN ALTERNATE SPECIAL TREATMENT OF LOW
RESERVE PER ACRE POOLS UNDER THE PRORATION PLAN

Finding the specific proposal of IPAC for an amendment to the proration plan unacceptable the Board has investigated alternative special allowables which do not incorporate the undesirable features of the IPAC proposal.

The Board expects that with increasing market demand allowables under the present proration plan will continue to increase until reservoir engineering-based restrictions to prevent waste will prevail. In effect, the need for prorating to market demand will be removed and some form of regulation based upon reservoir characteristics and recovery considerations will take its place. Pools and wells will be operated under "good production practice", this being defined, at least for the larger pools, by the results of individual-pool reservoir and well behaviour studies. When the need for prorating will disappear will depend upon the relative rates of growth of reserves and markets but, based on the present outlook, it may be expected within about five years.

The Board's general objectives in investigating various possible alternative incentive allowable plans were similar to those outlined in Section II of this report. Specifically, the Board believes that an incentive allowable should have the following characteristics.

1. The method should be applicable to, and accomplish the desired aims in, all qualifying pools.

2. It should contain an incentive to develop ultimate reserves through exploration, development drilling of low reserve per acre pools and the encouragement of enhanced recovery in those pools.

3. It should provide equitable treatment among qualifying pools. In addition, discontinuities in allowable rates should not occur at the point where a pool qualifies for an incentive allowable.

4. It should be reasonably simple, both to understand and to administer.

5. It should not encourage over-drilling.

6. It should minimize fluctuations in allowables for pools both in and above the low reserves per acre range.

7. It should not be damaging to ultimate recovery of any reservoir.

The Board has considered the consequences of allowing all pools with reserves below a certain level to produce at rates consistent with good production practice, subject to a maximum rate limitation (MRL) as it now frequently permits, on application, in special cases. This would amount to anticipating by a few years the termination of market demand prorating for such pools. If this were done the Board believes an incentive for exploration and development of low reserve per acre pools could be provided. However, in designing a system which incorporates a smooth transition from the MRL's allowed such pools to the normal prorated allowables for those pools not qualifying for the incentive, the Board believes it is necessary to provide some allowable advantage to those pools exhibiting an improvement in reserves per acre, thus retaining an incentive to install enhanced recovery schemes in the qualifying pools.

The Board has investigated several possible bases for an incentive allowable plan and has concluded that such an incentive could best be related to proratable reserves ($U-\frac{1}{2}P$). The Board believes such a basis provides consistency with the existing proration plan, could promote recovery improvement, and otherwise fulfills the objectives stated above.

As discussed in Section V (c), the Board considers low reserves pools to be those pools having less than 2000 barrels per acre. To provide a significant incentive at this level and to maintain adherence to its other objectives, the Board finds it necessary to extend the benefits of allowable incentives, on a declining basis, to some higher level of proratable reserves per acre. The Board concludes that a suitable upper limit would be 2500 barrels per acre and believes it appropriate that such a pool receive an incentive allowable equal to the allowable which the pool would receive under the market demand system of proration when the allocation factor is at the lowest anticipated level. The Board estimates that the minimum allocation factor that will be experienced in the future is about 100 barrels per day per million barrels of proratable

reserves. On this basis, the Board established an incentive allowable of 40 barrels per day per 160 acre DSU for qualifying pools having an average proratable reserve of 2500 barrels per acre as a reference point and the probable upper end of its incentive allowable plan.

In order to encourage enhanced recovery in low reserve per acre pools, the Board believes that the incentive allowable should recognize increasing proratable reserves per acre. Having regard for the costs and benefits to be expected from enhanced recovery in a typical low reserve per acre pool, the Board concluded that the incentive allowable per 160 acre DSU should increase at a rate of 40 barrels per day per million barrels of proratable reserves.

Figure VIII-1 illustrates, for a 160 acre DSU, the Board proposed incentive allowable (IA), the PRL⁽¹⁾, the minimum allowance amended as proposed in Section IX and the reserves-based prorated allowable (RBA) at an allocation factor of 100 barrels per day per million barrels, all as related to the pool average proratable reserves per acre. As shown, the incentive allowable line coincides with the reserves based allowable line at 40 barrels per day and intersects the PRL curve at an allowable of about 28 barrels per day per 160 acre DSU. Adoption of this plan would mean that pools having proratable reserves of less than 586 barrels per acre would be allowed to produce at their PRL. From 586 barrels per acre up to 2,500 barrels per acre the incentive allowable would exceed the reserves based, prorated allowable (when the allocation factor equals 100) by an amount varying from 0 to 15 barrels per day. This situation is illustrated by the yellow line on Figure VIII-1.

During months in which the allocation factor is greater than 100 barrels per day per million barrels, the upper limit of pools qualifying for the incentive allowable would have proratable reserves of less than 2,500 barrels per acre. For example, when the allocation factor reaches 150 barrels per day per million barrels only pools having

(1) PRL - A formula for making a preliminary estimate of the appropriate Maximum Rate Limitation; see OGCB Report 65-3, "Report and Decision on Review of Plan For Maximum Production Rate Limitation in Alberta."

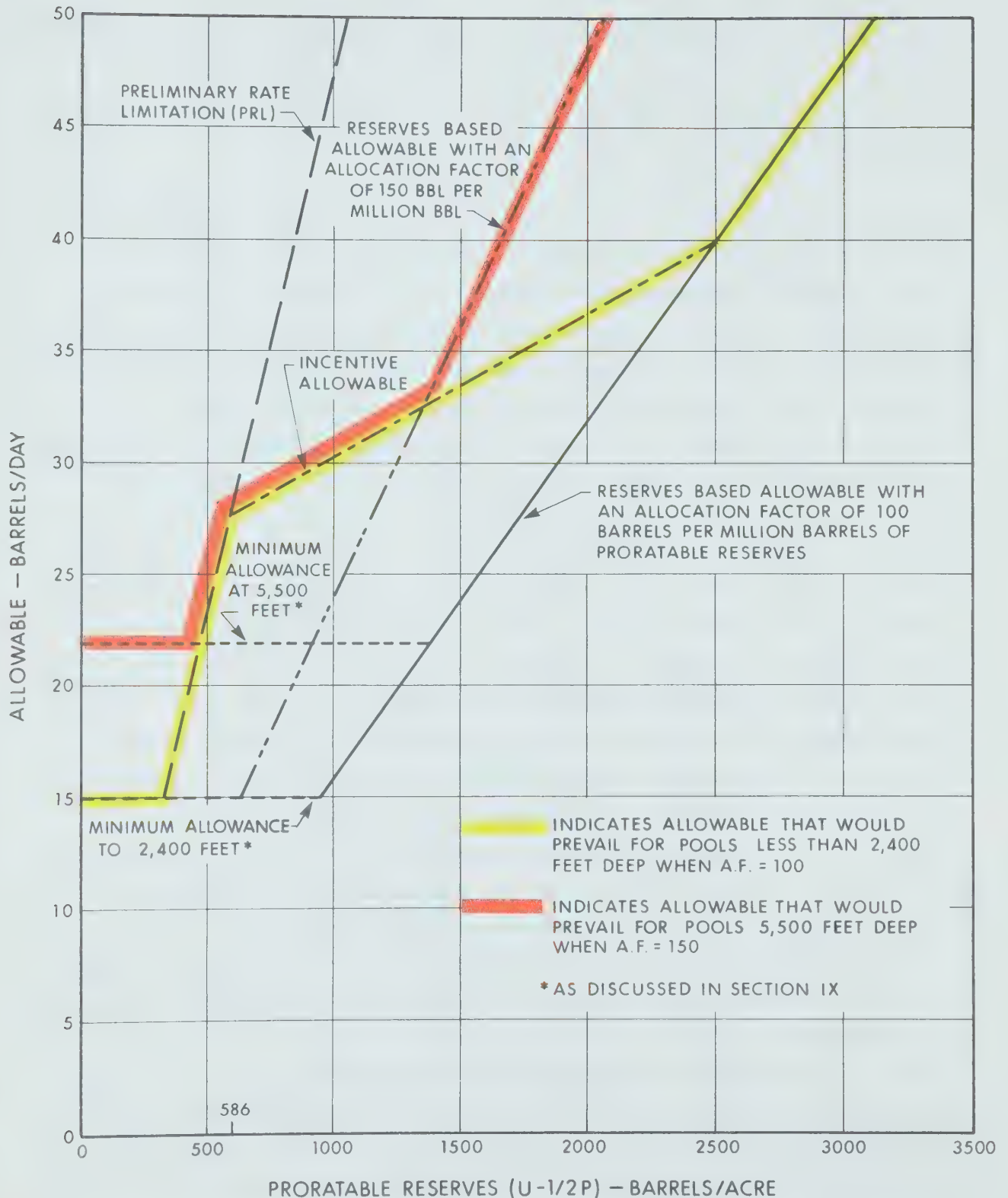


FIGURE VIII-1 — ALLOWABLE RATES FOR LOW RESERVE PER ACRE POOLS ON 160 ACRE SPACING

proratable reserves of less than about 1,350 barrels per acre would qualify for the incentive allowable. This is illustrated on Figure VIII-1 by the red line. As the Board anticipates the allocation factor will increase substantially in the future, the incentive allowable plan would gradually be phased out.

A disadvantage of adopting such a plan is that a reduction occurs in the proratable share of the Provincial demand for crude oil assigned to pools with reserves greater than those qualifying under the incentive allowable plan. The Board has estimated, based on the existing pools, that such an incentive plan would transfer about 8,000 barrels per day of production to the qualifying pools when the allocation factor is 100 barrels per day per million barrels. At higher allocation factors the impact would be progressively less. The Board has considered the magnitude of this impact and believes it is small enough to be tolerable, bearing in mind the possible overall benefit of the incentive allowable plan to the Province.

The Board believes that the incentive allowable plan described above should be administered on a "whole pool" basis and within the existing proration plan. The administration would have all of the features of the existing proration plan including monthly recalculation to determine whether the incentive allowable or the normal prorated allowable is of maximum benefit to a qualifying pool. The proratable reserve per acre would be calculated utilizing assigned productive acreage as at present, rather than a geological or isopachous interpretation of pool acreage. Depending upon the amount of the proratable reserve per acre, the pool allowable would be calculated using the appropriate formula consistent with Figure VIII-1 (see Appendix C) and would be distributed within the pool on the basis of acreage and Recovery Factor Modifier.

As is done with reserves-based allowables, a pool's incentive allowable would be adjusted if necessary, to compensate for physical incapability or regulatory restrictions within the pool, thus accomplishing within-pool redistribution. The allowables would be transferable

within the pool in accordance with the existing PSU, block and project regulations and would be subject to gas, water and off-target penalties. The monthly MD Order would be issued as at present, and the pool allocation in barrels per month per acre stated in Appendix 1 to the MD Order would be determined by the Board as the greater of the reserves based allowable or the incentive allowable.

Just as with the normal proration plan the Board recognizes that the incentive allowable, for very low reserve per acre but deep pools, might be so low as to prevent economic completion and operation of a well. Accordingly the minimum allowance of the proration plan would be applicable and a well would be entitled to produce at the greater of the incentive allowable or the minimum allowance for its depth. These figures would be shown in Appendix 1 to the MD Order and the operator would choose the greater value for his particular well and acreage situation. For illustrative purposes Figure VIII-1 displays minimum allowance lines at 15 and 22 barrels per day. In pools having average proratable reserves of less than 317 barrels per acre, the allowable assigned to a 160 acre DSU or PSU would be 15 barrels per day if the average well depth was up to 2,400 feet, and the allowable would be larger if the average reserve per acre was greater (yellow line). For pools having an average well depth equal to 5,500 feet, the allowable per 160 acres would be 22 barrels per day if the pool average reserve was less than 465 barrels per acre, and the allowable would be larger if the reserve per acre was more than 465 barrels (red line).

For tracts (DSU's, PSU's, blocks or projects) smaller or larger than 160 acres the allowables calculated using the PRL, IA and RBA formulae would each be proportionately smaller or larger than for a 160 acre tract but the intersection points between these lines would occur at the same level of reserves per acre. However, the level of the minimum allowance for a well is not related to reserves, but only to depth. Therefore the intersections of any particular minimum allowance line with the other allowable lines would occur at different reserves per acre levels than those illustrated on Figure VIII-1. For example (not

illustrated in a figure), a well drilled on 80 acre spacing in a pool having an average well depth of no more than 2,400 feet would still be entitled to a minimum allowance of 15 barrels per day if its proratable reserve was up to 633 barrels per acre, compared to 317 barrels per acre for an equivalent well on 160 acre spacing. For a 320 acre PSU the corresponding intersection point would be 158 barrels per acre. Stated another way, the allowables for the wells (and depths) discussed would be greater than the minimum allowance if the proratable reserve was greater than 633 barrels per acre for the 80 acre case, 317 barrels per acre for the 160 acre case, and 158 barrels per acre for the 320 acre case.

The overproduction and underproduction regulations currently applied to prorated pools would also be applied to the pools receiving the incentive allowable. A minor inconsistency arises, whereby some pools receiving an allowable equivalent to the PRL under the incentive allowable plan would be subject to a different set of overproduction and underproduction regulations than would a heavy crude oil pool having the same average reserves per acre and being subject to a similar maximum rate limitation, or even a light or medium crude oil pool which has been granted "good production practice" subject to a PRL ceiling rate. However, this inconsistency is not considered serious.

Pools receiving an allowable under the incentive allowable described above would still be eligible for "good production practice" (GPP) in accordance with the Board's existing policy, where this is indicated for the purpose of achieving conservation gain or administrative convenience. This policy is described in detail in Board Informational Letter No. IL 71-15.

IX ADEQUACY OF THE PRESENT MINIMUM ALLOWANCE

While the subject was not discussed at the hearing, the Board believes it suitable to review the basis on which the present minimum allowance was established and determine whether, for its originally declared purpose, the level of that allowance is appropriate under present conditions.

The purpose of the minimum allowance as described in OGCB Report 64-10 is to permit the recovery of completion and operating costs and to provide a satisfactory return on completion investment. The Board has reappraised the basis on which the level of the minimum allowance was established. The Board finds that a number of the factors on which the level of the allowance was based have changed since 1963-64 and that some revision is desirable in the level of the allowance.

Oil Well Completion Costs

Completion costs comprise the expenditures required to equip an oil well for production once it has been drilled. These costs include the charges for production casing, perforating, stimulating, tubing, wellhead equipment, a pump where one is required, and the well's share of flow lines and the battery.

The Board has reviewed completion costs for typical development wells drilled recently and concludes that on the average such expenses have increased some 15 to 20 per cent since 1963. The Board notes that currently development drilling is occurring mainly in or adjacent to established fields and that at present, when no new major fields are in the main development phase, the oilfield service industry is especially competitive. These latter factors appear in the recent past, to have offset the effects of inflation to some extent.

Direct Operating Costs

Operating costs are the expenses associated with maintaining and producing an oil well once it is completed. These expenditures comprise a number of relatively fixed amounts such as lease rentals, municipal taxes, insurance, workover outlays and overhead as well as variable costs. The variable costs depend on the rate of production and include equipment maintenance, production processing

costs and, where applicable, much of the enhanced recovery and water disposal payments.

Operating costs appear to the Board to have increased considerably since 1963 even after making allowance for a substantial amount of facility upgrading which occurred in 1971 in anticipation of improved production allowables. The increase appears to average about 40 per cent for shallow wells, probably caused by the implementation since 1963 of enhanced recovery operations which have been predominantly in shallow reservoirs. Based on the data available to the Board, the extent of the increase in operating expense as a percentage appears to decline to some 10 per cent at 12,000 feet.

Geographical Location

Both completion and operating costs for oil wells vary extensively from area to area and are substantially higher for small new fields remote from service facilities and lacking dependable transportation. The variation in such outlays for wells at the same depth appears to be greater currently than it was in 1964. As in 1964, the Board does not believe it is justifiable to include a factor in the minimum allowance schedule to take account of the effects of individual field location. However, the Board observes that the prospects for new discoveries are greatest in the least explored, remote areas of the Province. The Board therefore believes that a further upward adjustment of 5 to 10 per cent in the average completion cost and operating cost data for various depths described above is warranted in the present circumstances to give further weight to costs experienced at remote development wells.

Wellhead Value of Crude Oil

The average value of crude oil used in 1963 in determining the minimum allowance level was \$2.48 per barrel. In 1971 the average price was \$2.84 per barrel or some 13 per cent higher and it appears probable that a more rapid escalation in crude oil prices can be expected in the future. This rise in crude oil prices

since 1963 offsets only part of the increase in costs experienced in the period.

Applying the same considerations it did in 1964 but taking account of the changed circumstances as discussed above, the Board has recalculated its schedule of minimum allowance versus well depth. It finds the revised figures to be some 50 per cent higher than the former figures for wells under 3,000 feet in depth and some 30 per cent higher for wells of 12,000 feet depth. The revised figures are given in Table IX-1 and Figure IX-1.

The Board estimates that, when the allocation factor equals 100, granting these new levels of minimum allowance will withdraw 2,000 barrels per day of light and medium crude oil production from the higher reserve per acre pools. This impact is in addition to the estimated 8,000 barrels per day of production transferred from high reserve per acre pools under the incentive allowable plan. The estimated total impact represents some 1 per cent of the present demand for prorated Alberta crude oil. During months when a higher allocation factor prevails, the impact of both the minimum allowance and the incentive allowable would be reduced.

TABLE IX-1

TABULATION OF MINIMUM ALLOWANCES

Effective June 1, 1972

<u>Pool Average Well Depth-Feet</u>	<u>Minimum Allowance Barrels Per Day</u>	<u>Pool Average Well Depth-Feet</u>	<u>Minimum Allowance Barrels Per Day</u>
0 - 2,400	15	10,801 - 11,000	41
2,401 - 3,000	16	11,001 - 11,200	42
3,001 - 3,500	17	11,201 - 11,400	43
3,501 - 3,950	18	11,401 - 11,600	44
3,951 - 4,400	19	11,601 - 11,800	45
4,401 - 4,850	20	11,801 - 12,000	46
4,851 - 5,250	21	12,001 - 12,200	47
5,251 - 5,650	22	12,201 - 12,400	48
5,651 - 6,050	23	12,401 - 12,600	49
6,051 - 6,450	24	12,601 - 12,750	50
6,451 - 6,800	25	12,751 - 12,900	51
6,801 - 7,100	26	12,901 - 13,050	52
7,101 - 7,400	27	13,051 - 13,200	53
7,401 - 7,700	28	13,201 - 13,350	54
7,701 - 8,000	29	13,351 - 13,500	55
8,001 - 8,300	30	13,501 - 13,650	56
8,301 - 8,600	31	13,651 - 13,800	57
8,601 - 8,900	32	13,801 - 13,950	58
8,901 - 9,150	33	13,951 - 14,100	59
9,151 - 9,400	34	14,101 - 14,250	60
9,401 - 9,650	35	14,251 - 14,400	61
9,651 - 9,900	36	14,401 - 14,550	62
9,901 - 10,150	37	14,551 - 14,700	63
10,151 - 10,400	38	14,701 - 14,850	64
10,401 - 10,600	39	14,851 - 15,000	65
10,601 - 10,800	40		

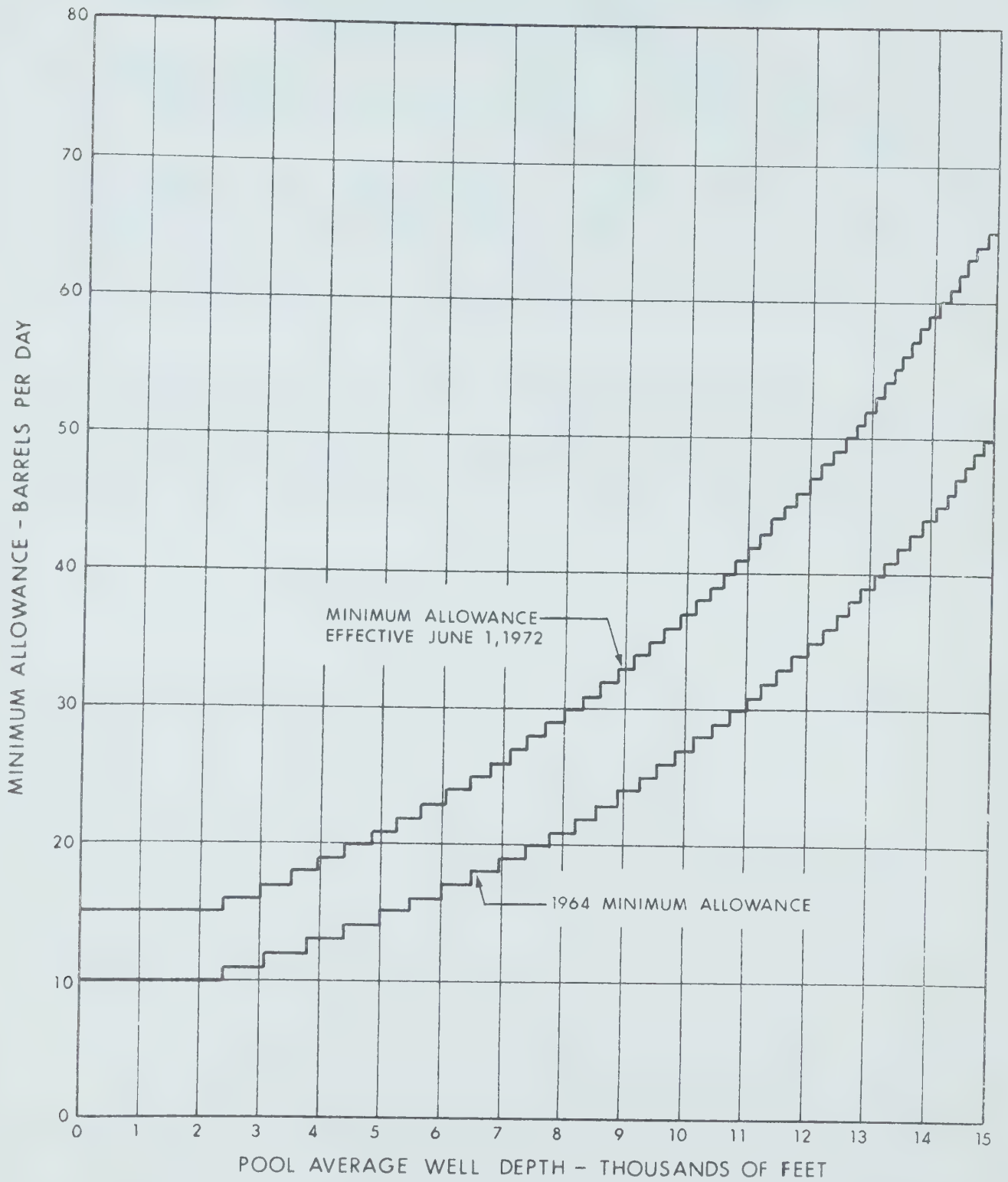


FIGURE IX-1 - MINIMUM ALLOWANCE SCHEDULES 1972 AND 1964

X DISPOSITION OF THE IPAC APPLICATION AND THE BOARD'S DECISION
REGARDING AN INCENTIVE ALLOWABLE

As discussed in Sections IV and V, the Board recognizes the need for an incentive to stimulate exploration and development in low reserve per acre crude oil pools.

The Board agrees with IPAC and some of the interveners that an incentive could be provided through the proration plan. Effective June 1, 1972, it will modify the proration plan through the adoption of the Incentive Allowable plan described in Section VIII of this report.

The Board does not expect that the allowable incentive will fully meet the need which exists for an incentive to encourage further exploration for crude oil pools, and believes that further consideration should be given to providing incentives by means other than through the proration plan.

XI AMENDMENT TO THE MINIMUM ALLOWANCE SCHEDULE

For reasons set forth in Section IX of this report, the Board amends the Minimum Allowance Schedule of the proration plan by substituting, effective June 1, 1972, the schedule presented in Table IX-1 for the subsisting Schedule 5 to the Oil and Gas Conservation Regulations. The new minimum allowance schedule will apply to wells in both heavy crude oil pools and light and medium crude oil pools.

APPENDIX A

THE LAHEE GEOLOGICAL CLASSIFICATION OF WELLS

On January 1, 1964, the Board implemented the Lahee system for classifying wells. The Lahee system was adopted about twenty years before by the American Association of Petroleum Geologists for world-wide usage. This system provides a standard basis for compiling statistics and it replaces the modified Lahee system used by the Board before 1964.

The well categories of the Lahee system are defined below:

1. Development Category

A development well is a well drilled with the object of further exploiting the "pay horizon" of a pool within the area which has already been essentially proved for production in this pool. Such a well may be inside the pool as already outlined by producing (or producible) wells, or it may be a relatively short distance outside these limits.

A development service well is a well drilled for the purpose of introducing fluids into an underground formation or observing the performance of a reservoir.

2. Exploratory Category

An outpost is a well drilled with the thought that it will probably extend, by a considerable distance, a pool already partly developed. Its original objective is the producing formation of this pool, although it may be completed or abandoned at a higher, or at a lower, stratigraphic horizon. It is far enough from the limits of the pool, as known at the time when its drilling is started, to make its outcome uncertain, but it is not far enough from these limits to be designated a wildcat. If it is successful in its original object, it will add materially to the productive area of the pool. It may be dry.

A shallower-pool test is a well located within the known limits of a pool and drilled with the object of searching for new producible horizons above the producing (or producible) formation of the pool. It should be pointed out that the Board normally classifies such a well as a development well. In the Board's opinion, such a well is generally drilled on the basis of information obtained from the up-hole part of an adjacent well in the field. Under these circumstances,

the well is simply drilled to develop a shallower zone that was previously known to contain hydrocarbons.

A deeper-pool test is a well located within the known limits of a pool and drilled with the object of searching for new producible formations below the producing (or producible) formation of the pool; or, if there are two or more overlapping pools, below the producing (or producible) formation of the deepest pool penetrated by this well.

A new-pool wildcat is a well (1) located at a relatively considerable distance outside the limits of producing (or producible) pools as these limits are known at the time of drilling and (2) drilled on a structure or in a geological environment where other pools have been found but where the complexities in the underground geological conditions are so great that searching for a new pool is very hazardous. The objective of a new-pool wildcat is the discovery of a new pool in a field already discovered.

A new-field wildcat is a well (1) located at a relatively considerable distance outside the limits of producing (or producible) pools as these limits are known at the time of drilling and (2) drilled on a geologic structure or in a geologic environment where hydrocarbons have not yet been discovered. The objective of a new-field wildcat is the discovery of a new field.

APPENDIX B

THE DEFINITION OF MAJOR AND MINOR OPERATORS (LICENSEES)

Major Operators

Amoco Canada Petroleum Company Limited

(Pan American Petroleum Corp.)

Chevron Standard Ltd.

Gulf Canada Ltd.

(British American Oil Co. Ltd.)

Hudson's Bay Oil and Gas Co. Ltd.

Imperial Oil Ltd.

(Imperial Oil Enterprises)

Mobil Oil Canada Ltd.

Pacific Petroleum Ltd.

Shell Canada Limited

Texaco Canada Ltd.

Texaco Exploration Canada Ltd.

Minor Operators

All Other Licensees (over 200)

APPENDIX C

THE INCENTIVE ALLOWABLE

The equations of the lines representing the Preliminary Rate Limitation (PRL) and the Incentive Allowable (IA), as described in Section VIII, are:

(1) For pools having an average prorable reserve ($U - \frac{1}{2}P$) from 0 to 586 STB per Acre:

$$\text{Pool Allowable (B/day)} = \text{PRL} = .000296 (U - \frac{1}{2}P)_{\text{pool}},$$

rounded to the nearest whole barrel per day

(2) For pools having an average ($U - \frac{1}{2}P$) greater than 586 STB per Acre:

$$I A = .00004 (U - \frac{1}{2}P)_{\text{pool}} + .15 (\text{Pool Productive Acreage}),$$

rounded to the nearest whole barrel per day

In each case, if the minimum allowance or the normal prorated allowable is greater than the IA, the largest one will prevail.

APPENDIX D

DEFINITION OF TERMS USED IN THE REPORT

Allocation Factor - A number relating the market demand for Alberta conventional light and medium crude oil and equivalent, and the total Provincial proratable reserves. The factor is determined and published monthly by the Board, to be multiplied by the proratable reserves of a pool to calculate the pool's crude oil production allowable for the period. Expressed as barrels per day per barrel of proratable reserves or a multiple thereof.

Allowable - The amount of oil (or gas) a well, PSU, block or project is permitted to produce, in accordance with an order of the Board for this purpose, after application of any applicable penalty factor.

Assigned Acreage - The area used by the Board in determining a well, block or project's share of a pool allowable. Normally equal to the sum of the areas of the DSU's included within the PSU, block or project.

Block - An area or part of a pool consisting of production spacing units grouped for the purpose of obtaining a common, aggregate production allowable.

Drilling Spacing Unit (DSU) - The area prescribed by or designated pursuant to the Oil and Gas Conservation Regulations, to be used in determining the allowable of a well and within which a well may be drilled.

Dry Hole - A well which failed to encounter oil or gas in commercially producible quantities.

Heavy Crude Oil - Generally crude oil having an API gravity of 25° or less, which corresponds to a specific gravity greater than 0.9 relative to the density of water.

Incapable Well - A well which is unable to produce its allowable, due either to physical limitations of the well or reservoir or to regulatory restrictions or penalties.

Good Production Practice (GPP) - Production of crude oil (or gas) at a rate not governed by an allowable but limited to what can be produced without adversely affecting conservation or the rightful opportunities of other owners.

Infill Drilling - The drilling of wells within the previously established outline of a pool.

Light and Medium Crude Oil - Generally crude oil having an API gravity greater than 25°, corresponding to a specific gravity of 0.9 or less relative to the density of water.

MD Order - An order issued monthly by the Board containing a listing of allowables assigned to producing pools within the Province, calculated to result in production that would satisfy the market demand.

Maximum Rate Limitation (MRL) - The maximum rate of production from a pool prescribed for the avoidance of waste, after application of any applicable penalty factor.

Minimum Allowance (MA) - The lowest base allowable assigned to a well, related to the producing depth of the pool, designed to allow return of the producing costs and prevent premature abandonment.

On Production Date - The day on which a well first commenced more-or-less continuous production utilizing normal production facilities and equipment.

Penalty - The factor applied to the base allowable to determine what the allowable will be after reduction on account of excessive water-oil ratio, excessive gas-oil ratio or off-target location.

Preliminary Rate Limitation (PRL) - An initial determination, by application of a published formula, of the maximum rate limitation (MRL).

Production Spacing Unit (PSU) - A tract of land containing at least one well and grouped for the purpose of receiving and producing an allowable.

Productivity - The maximum rate of production of which a well is capable subject to production facilities and pipe line constraints.

Project - A pool or part thereof in which operations in accordance with a scheme for enhanced recovery for oil are conducted.

Proratable Reserves - The measure of oil reserves used in determining the base allowable of a pool, defined by the Board as the average of the initial recoverable reserve and the remaining recoverable reserve, numerically equal to the initial or "ultimate" recoverable reserve minus one-half the cumulative production. ($U - \frac{1}{2}P$).

Recovery Factor Modifier (RFM) - A measure of the ratio of increase in recovery attributable to implementation of enhanced recovery in a pool, used as an acreage multiplier (modifier) in determining the share of a pool's allowable to which a project or enhanced recovery scheme is entitled.

Reserves-Based Allowable (RBA) - The allowable to which a pool, well, etc. would be entitled as calculated using the allocation factor and the proratable reserves.

Service Well - A well used for a purpose other than the production of oil or gas, such as injection, water disposal or measurement of sub-surface parameters.

Step-Out - A well drilled for the purpose of extending the known boundaries of a pool or of finding a new pool in a similar geologic horizon and near a previously discovered pool.

Suspended Well - A well which once produced oil or gas but which has subsequently been withdrawn from production although not abandoned.

Validated Tract - A drilling spacing unit not containing a well, which is combined in a PSU with a tract which does contain a well. Recognized by the Board as being a potentially productive tract and considered to be assigned acreage for allowable purposes.

